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ABSTRACT

These hearings focused on issues related to the joint use of federally-funded research facilities by industry and universities. Testimony of witnesses, prepared statements, and supporting documentation (including the Stevenson-Wydler Technology Innovation Act of 1980, Public Law 96-480) are provided. Witnesses presenting testimony included: Louis C. Ianiello; James M. Williams; Harry Wugalter; William Stephens; Edgar L. Kendrick; William E. Gahr; Gerald Killian; Jerry Calvani; J. Ritchie Smith; Ed Hughs; A. William Snyder; Harold Daw; Koert Lessman; William Dutton; Claire Newcomer; George O'Connor; and James Whitford. Among the issues/areas discussed by these witnesses are: areas for improvement in the cooperative use of facilities; three initiatives at the Los Alamos National Laboratory for improving communication related to maximum effective use of the science/technology in which the federal government has invested at the laboratory; long-/short-term benefits of encouraging joint use of federally-supported facilities in agricultural research; the current administration's policy to form new partnerships whereby federal and non-federal entities share responsibilities for water resources research and information gathering; and mechanisms on how the United States Department of Agriculture can more effectively work with the cotton industry and New Mexco State University to utilize and support federally owned and operated agricultural research facilities. (JN)

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JOINT INDUSTRY/UNIVERSITY COOPERATION WITH FEDERALLY SUPPORTED RESEARCH FACILITIES

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HEARING

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST SESSION

MAY 13, 1983

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JOINT INDUSTRY/UNIVERSITY COOPERATION WITH FEDERALLY SUPPORTED RESEARCH FACILITIES

FRIDAY, MAY 13, 1983

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 194, Auditorium of Agriculture Building, New Mexico State University, Las Cruces, N. Mex., Hon. Joe Skeen presiding.

Mr. SKEEN. We would like to start as nearly as possible on time, which is an unusual sort of a thing for politicians, but we would because we have got a lot of things we would like to talk about today. We have some extremely important witnesses who are going to be here to discuss the problems in the areas we have outlined in the hearing. And also, we have some people who have to catch planes at around 2 o'clock. So, depending on how the pace goes, we are going to try to move this thing along, give everybody their opportunity to have their say, and also have a little participation, I think, from the public if they care to, insofar as the discussions concerning the topics that we're going to cover in this hearing.

I want to begin by welcoming—and I'm pleased to have with me—a good friend of mine. This is his first term in Congress, he is from Illinois. And I know as much about Illinois and their problems, as he knows about New Mexico and our problems, but together we've covered a lot of problem areas and come up with a lot of solutions that we can't find problems for. But I want to welcome Dick Durbin, who has become a good friend of mine, and I have great admiration for him. He brings a good quick mind to agriculture and the science of technology in the Congress. We both serve on the same committees. And Dick, despite the fact that we parade him by bringing him in late last night, along with the rest of us—we left the floor of the House of Representatives yesterday at anywhere from about a quarter to 5 to about 6 o'clock, I think, and then flew into El Paso. So he did not have the opportunity to even try our chili until this morning.

I just want to welcome you, Dick, and appreciate having you here in our part of the country. Of course, he represents the majority party and I represent the minority party, and together we do a fine job watching one another. Let's give Dick a big welcome.

Mr. DURBIN. Joe, if I can, first let me say it's all mine, and second, let me tell you you haven't had the pleasure, I think of vis-

iting my home city of Springfield, Ill., which boasts not only the place where Abraham Lincoln once served in Congress, but also it's the chili capital of the United States, which you probably didn't know until I arrived here. We're anxious to bring you in and let you try some of the local product.

But I would say in all seriousness that this is a meeting which brings together our two committee assignments and, I think, really points to the future. Everyone talks about high technology. High technology is just an abstract term unless you can apply it to your locality. In my locality, Springfield, Ill., with rich agricultural resources, and your locality in New Mexico, with the agriculture potential that you have, we can bring together, I think, the opportunity for both high technology and improvement in agriculture. And I think that points in a realistic direction and gets away from the abstract into the specific.

This meeting today to discuss the cooperation of industry, university, and Government, the suggestion of where we're going in agricultural research could just as easily be taking place in my home town as it could in Las Cruces. I appreciate the opportunity to be here today, and I am looking forward to the hearing. Joe, thanks for your fine hospitality.

Mr. SKEEN. Thank you very much, Dick, and I am sorry that you can't spend more time down here because we are very proud of our State, and particularly this part of the country. And if Springfield is the chili capital of the world, then we have got a very serious conflict going on. But I have got to tell you that after witnessing some of the products that some of the Easterners, Midwesterners—particularly New Yorkers—call chili, and even some of our own cohorts in the South, we have got some very serious discussion. But we will take that up at another time.

I want to ask unanimous consent, if I might, to have a statement put in the record from the president of the New Mexico State University, Dr. Gerald Thomas, and I want to thank the president, the members of the board of regents, the faculty, and the students for allowing us to come in and use this fine facility. And I couldn't think of a better place in which to hold this kind of a discussion and to bring the Investigations and Oversight Subcommittee hearing to New Mexico than this very appropriate place for it, because so much of this work is ongoing at this university. We're very proud of this institution. So with that, I would like to ask consent to have Dr. Thomas's statement made a part of the record, along with various other documents.

[The statement of Dr. Thomas follows:]

Statement of Gerald W. Thomas
President, New Mexico State University
Las Cruces, New Mexico

May 13, 1983

The Hon. Joe Skeen and members of the Committee:

Thank you for the opportunity to present this opening statement to the Committee hearings. First of all, let me welcome you to the campus of New Mexico State University and extend to you our best wishes for a successful and productive hearing.

The issues that you are considering today are important to this State and to the Nation. The long-time partnership between the Federal government and the universities is the key to the development of our educational and research programs in this Nation. In the case of New Mexico State University, this partnership dates back to 1890 when our institution was named the land-grant college for the territory. During the interim period, we have not only had cooperative programs with various departments of the Federal government, but we have had joint use of facilities and equipment in many of our research and academic endeavors. Some of the examples of this relationship will be discussed by members of our faculty and staff in the hearings here today.

The two most important areas for improvement in cooperative use of facilities are:

1) Economic development for the State and Nation, i. e. programs ranging from agriculture to engineering to business, science and the environment.

2) The second area where there are vast opportunities for improving the relationships between the Federal government and the states is in national defense. New Mexico State University is now ninth in the nation of all universities in the ranking of Dept. of Defense contracts. These activities are at the Physical Science Laboratory in Science and Engineering Departments, and at White Sands and the other federal labs. Our heavy involvement in Space research also provides a basis for improved relationships.

Good luck in your hearings and best wishes for developing successful solutions to the pressing problems that lie ahead.

GWT/jm

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Mr. SKEEN. I have a communication here from the Special Energy Research and Development Institute, and we will allow them to place their statement by letter in the record, if there is no objection.

Mr. DURBIN. No objection.

[The letter from the New Mexico Energy Research and Development Institute follows:]

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May 12, 1983

Representative Joseph Skeen
House of Representatives
Washington, D.C.

Dear Representative Skeen:

The hearing being held on the use of the national laboratories by industry and non-federal agencies is an important occasion for us at the New Mexico Energy Research and Development Institute. We find the prospect that industries can utilize laboratory facilities and expertise in developing and testing new products to be a very significant new federal initiative. While we are interested primarily in New Mexico industries, others throughout the country will be able to benefit as well. We in New Mexico already have benefitted from early steps by Los Alamos and Sandia in this direction.

As the program develops we hope that the policies of the laboratories toward assistance to industry will become clearer. At present we do not know what to tell industries about the amount of help they can expect to receive. Some guidelines would be helpful although I would hope that considerable flexibility would be maintained as well.

Sincerely yours,

George W. Hinman

GEORGE W. HINMAN
Director

GWH:mmb

Room 358, Piñon Building, 1220 S. St. Francis Drive, Santa Fe, NM 87501 • (505) 827-5886

Mr. SKEEN. Today's hearing is going to cover three critical issues in New Mexico's—and I think the rest of the Nation's economy—having to do with agriculture, high technology, and water issues. Our economic prosperity, our standard of living, and our very future depend upon these three factors.

Our dependence on agriculture is self-evident. There isn't any quarrel about that. The very roots of our culture stem from a life off the land, either from the production of food crops or in the careful management of our rangelands. Critical to our continued prosperity in this area is ongoing research to keep us abreast of the newest agricultural techniques in breeding, planting, pest management, harvesting, and processing. We are not harvesting pits no matter how it reads. No endeavor of commerce, be it agricultural or otherwise, can long survive if it doesn't keep pace with new scientific knowledge. I think that's been more evident in New Mexico and throughout the rest of the Nation because you would think as long as this Nation has depended upon its agricultural base, that we would pretty well have covered just about every facet or innovation possible. We're finding that we're just on the edge of the entire frontier. We have not nicked the surface at all. New techniques in plant gene control, splicing, and things of that kind are opening up entire new fields.

This is exactly why the Southwestern Cotton Ginning Research Laboratory is so important to New Mexico, and when these hearings sprung up, there was a possibility that we would discuss closing the Southwestern Cotton Ginning Research Laboratory. And, of course, those of us in New Mexico's delegation took strong exception to that, along with Members of Congress from Arizona, California, and Texas.

The cotton crop, like the roll of the Sun, is moving west. We will hear from witnesses on the second panel how important this cotton gin research is, not just to New Mexico, but to the growers and ginners in western Texas, Arizona, and California. I have strongly objected to the closing of this facility, and subsequent to the announcement of this hearing, the Agriculture Research Service [ARS] has postponed the proposed closing of the research lab for at least 2 years, and do something of an analysis as to really how important this facility is to not only just the regional area of New Mexico, but also the general area of all these States combined.

I am very pleased that representatives of ARS [Agricultural Research Service] are with us today, and I think that when they hear today's testimony, that we will see that the facility probably will stay open for some time. We hope to establish that.

High technology is vitally important to a growing New Mexico economy, along with any other State in the United States. It's the new industrial frontier. We've known this for some time. We're the greatest technologists in the world, and we have lived from our technology as a Nation for years and years. But as our land reaches the reasonable limits of what it can produce in the way of minerals, crops, and livestock, we must, if we want continued prosperity, develop new and environmentally safe industries. When we assess New Mexico's scientific talents associated with our fine universities and Federal laboratories, we can see a great opportunity to join our talents with the needs of an expanding high technology

industry. Electronics and information processing promises to be the world's second largest industry, second only to energy, by the year 2000. It makes a great deal of sense, therefore, to bring New Mexico into the mainstream of environmentally safe high technology industrialization. Our third panel today will review the progress on the so-called Rio Grande Research Corridor and explore ways the Federal Government might help.

In the fourth and last panel we will hear from a Department of the Interior witness on the status of water research priorities and funding. Nothing is more dear to New Mexico than water, and all the new data shows the situation is getting worse.

I see that the El Paso Times has a big lead story over on the Pecos watershed. We have already gone through the El Paso determinations and so on, so we see that the competition from municipalities, new industries, along with the prior users—those being in agriculture—are coming to a great position of conflict with one another, and a great position of buying for what usable sources and resources of water that we have.

In meetings with my staff and the Congressional Office of Technology Assessment [OTA] on a soon to be released study on the water needs in arid and semiarid areas of the United States, I have been encouraged by the important role water-related technologies can play in solving this critical problem of growing proportions.

We know all too well that agricultural water supplies suffer from declining water tables as well as agriculture's inability to compete on the open market for available water. The inefficiency of conventional agriculture systems is compounded by the higher energy costs of water that must be transported farther and lifted from even deeper acquifers. With over 80 percent of New Mexico's crops produced with irrigation, water technology research becomes more than a line item in a budget or an ivory tower research project, it becomes a life-saving technology for an entire region of the United States.

We will hear today how a research project slated for termination by the Federal Government has been turned over to the city of Roswell, in effect saving the vital desalinization research at the Roswell facility. Hopefully, other projects slated for closing as research priorities change and research dollars stabilize, can be saved through similar local initiatives involving the Federal Government, universities, and private industry.

This brings me full swing around to our first panel, which will provide an overview for the common denominator of the hearing; namely, the joint use of federally supported research facilities by the universities and private industry. The underlying issue is how the joint use of federally supported research facilities might enhance the national research endeavor, reduce the levels of direct taxpayer support, as well as benefiting the overall technology transfer process and the resulting increases in innovation and productivity. The feeling here is that collaborative research efforts among Government, universities, and private industry will not only stretch the research dollars for all involved, but actually improve the quality of the research itself and improve its eventual development into something useful to society.

Members of the first panel will explore this issue, building on the examples to be discussed by the three panels dealing with the cotton gin, the Rio Grande Research Corridor and water research.

If we could begin with the first panel, I would like very much to have them come up. In order of appearance, Dr. Louis C. Ianniello, who is the Director of Division of Materials Science, Office of Basic Energy Research, Department of Energy, Washington, D.C., Dr. James M. Williams, who is the assistant director for Planning and Analysis, Los Alamos National Laboratory, Los Alamos, N. Mex., Mr. Harry Wugalter, who is no stranger to us, except he has moved to Thousand Oaks, Calif., and is the communications and academic affairs manager at Rockwell International. He also proves to me there is no such thing as an ex-marine, only former marines; Dr. William Stephens, who is the Secretary of Agriculture for the State of New Mexico, Santa Fe, N. Mex.

STATEMENTS OF DR. LOUIS C. IANNIELLO, DIRECTOR OF DIVISION OF MATERIALS SCIENCE, OFFICE OF BASIC ENERGY RESEARCH, DEPARTMENT OF ENERGY, WASHINGTON, D.C.; DR. JAMES M. WILLIAMS, ASSISTANT DIRECTOR FOR PLANNING AND ANALYSIS, LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, N. MEX.; HARRY WUGALTER, MANAGER OF COMMUNICATIONS AND ACADEMIC AFFAIRS, ROCKWELL INTERNATIONAL, THOUSAND OAKS, CALIF.; AND DR. WILLIAM STEPHENS, SECRETARY OF AGRICULTURE, STATE OF NEW MEXICO, SANTA FE, N. MEX.

Dr. IANNIELLO. Mr. Chairman and members of the subcommittee, I am happy to be here to discuss the Department's position on joint use of research facilities. In using the term "facilities," I am not referring to any total laboratory complex such as the Los Alamos National Laboratory [LANL] itself, but to those special, unique facilities within a laboratory identified for user collaboration. Examples within Los Alamos would be the Clinton P. Anderson Meson Physics Facility and the Pulsed Neutron Research Facility. In general, DOE encourages joint use in order that these special facilities be used by all qualified researchers wherever they are located—at universities, in industry, or at laboratories other than the host laboratory. These facilities are the ones which have general applicability for basic or applied research and not the ones constructed for restricted use such as certain weapons-related facilities or energy technology facilities.

Within the Department, these general facilities fall mainly under the management of the Office of Energy Research [OER] programs. The Office of Energy Research contains four major outlay programs: First, the Office of High Energy and Nuclear Physics which supports several research facilities operating in a user mode primarily for university participants; second, the Office of Magnetic Fusion Energy which supports certain facilities for their own programmatic objectives; third, the Office of Health and Environmental Research; and fourth, the Office of Basic Energy Sciences [BES]. This latter program has the greatest variety of interactions with industry and universities within OER. The BES program includes activities in materials sciences, chemical sciences, biological

energy research, engineering, mathematics, geosciences, nuclear sciences, and advanced energy projects. I am the Director of Materials Sciences, the program where most of the major facilities are located, and I will provide some specific data on joint use related to that program later.

The Department of Energy and predecessor agencies have had extensive experience in constructing, operating, and conducting research utilizing major research facilities. It is an important objective of the basic energy sciences program to provide advances in the area of large, unique, high technology facilities important to energy and the Nation's scientific and technological future. The Nation's primary expertise in accelerator, nuclear reactor, laser and computer-based facility design lies in the Department's laboratories such as the two here in New Mexico, Los Alamos and Sandia. Over the years, researchers from all parts of the country and the world using these facilities have participated in scientific and technological experimentation of great benefit to mankind. Advancement of scientific knowledge and insights in the various fields of science related to energy is the principal reason for BES's continued involvement with large facilities. The availability of these unique facilities plays a large role in U.S. world leadership in several fields of science such as radiation effects, neutron scattering, electron microscopy, and synchrotron radiation research.

In recognition of their uniqueness, a number of the facilities have been designated as user facilities or collaborative research centers. Their primary use is for the conduct of BES-funded energy-related research. However, the facilities have been made available to qualified scientists irrespective of their organizational association. The research to be done must be of documented programmatic interest to DOE and must undergo rigorous review by members of the scientific community. The facility manager is expected to allocate the use of the facility in a manner that attains the maximum scientific quality and accomplishments. Where the results are to be published in the scientific literature, there will be no charge to the user for the operation of the facility. If a user wishes to do proprietary research, full-cost recovery is required. A patent waiver, either blanket or individual, may be granted.

In order to make available to the community in general information on the major research facilities, the Office of Energy Research has published a number of documents listing the facilities together with their capabilities. The report DOE/ER-0139, "Office of Energy Research Major Facilities—Capsule Summaries" October 1982, is one such document and it contains a description of 25 of the largest OER facilities located in the Magnetic Fusion Energy, Basic Energy Sciences, High Energy Physics, and Nuclear Physics programs. Within BES, the major user facilities include: the High Flux Beam Reactor [HFBR] at Brookhaven National Laboratory [BNL], the High Flux Isotope Reactor [HFIR] at Oak Ridge National Laboratory [ORNL], the Intense Pulsed Neutron Source [IPNS] at Argonne National Laboratory [ANL], the Pulsed Neutron Research Facility at Los Alamos National Laboratory [LANL], the National Synchrotron Light Source (NSLS) at BNL, the Combustion Research Facility [CRF] at Sandia National Laboratory [SNL]-Livermore, the Stanford Synchrotron Radiation Laboratory [SSRL] at

the Stanford Linear Accelerator Center, and the electron microscopy facilities at ANL, ORNL, and the Lawrence Berkeley Laboratory [LBL]. The operation of these major facilities plus other minor ones requires over $40 million currently or over 15 percent of the BES operating budget.

I would like to take a moment now to summarize the use of the BES research facilities. As an example, I will use the materials sciences program facilities. We provide about $21 million to operate them, out of a budget of $108.7 million. The replacement cost for these facilities is estimated at $450 million. The materials sciences research funding at these facilities equals $16 million, with another $11 million being attracted from outside materials sciences. Of the approximately 900 users of the materials sciences facilities, 21 percent are from DOE laboratories, 7 percent from other Federal laboratories, 48 percent from universities, 14 percent from industry, and 10 percent from foreign and other organizations. Of the research that is done locally by the host laboratories, 65 percent is supported by materials sciences and the remainder by other programs. Two other large BES facilities outside of the materials sciences program are the SSRL and CRF. The distribution of users at these two major facilities is: 39 percent from universities, 26 percent from industry, 24 percent from DOE laboratories, and 11 percent from foreign and other organizations. Thus, one can conclude from this information that there is a very significant use made of these facilities by non-DOE researchers whereby DOE has been able to leverage a much larger research program for the Nation.

Of prime importance in all these interactions is the research output and usefulness of the facilities. One gage of the usefulness is the extent to which the facilities are sought for research. We watch this carefully and presently find that all of the BES facilities have more users than can be reasonably accommodated within the facility operating schedule. Another gage is the extent to which non-DOE organizations are willing to spend funds or time associated with the facilities. A few examples include: First, industry has provided over $5 million to help equip the NSLS; second, industry has been willing to pay for operating time at IPNS in order to keep the facility running longer; and third, industry has recently provided the HFBR with $0.5 million to develop a neutron detector for general use.

With regard to technology transfer, the research facilities do serve as a major focal point for interaction among the university, industry, and DOE laboratory scientists. Oftentimes experiments are conducted jointly. We believe this is the best way to enhance the transfer of technology—through the hands-on operation and intimate interactions possible at these facilities. The usual open literature publications, meetings, and workshops are also part of our continuing effort to transfer information and technology. In addition, each laboratory has a plan specifically tuned to its own situation for technology transfer. These have all been documented elsewhere—for example, the report of the Energy Research Advisory Board's panel on the multiprogram laboratories.

The joint use of major DOE facilities by qualified researchers irrespective of their organization has not only enabled the DOE to

acquire information faster, but has enabled the quality of the research to be maintained at the highest possible level.

A few examples of recent exciting research made possible by these facilities include: First, the discovery of the coexistence of ferromagnetism and superconductivity made possible by neutron scattering experiments, second, successful research using synchrotron radiation for X-ray lithography, making possible the preparation of photoresists containing the circuit pattern with extremely small features useful for microelectronics applications; third, successful use of synchrotron radiation to image constrictions in blood vessels; and fourth, in-situ microscopy observations of materials while undergoing damage due to radiation.

Mr. Chairman, that concludes my formal statement. I would be happy to answer any questions you might have.

Mr. SKEEN. Thank you very much, Dr. Ianniello. We are going to hold the questions until the entire panel has given their statements.

I also would like to say if you care to summarize your statements, we will put in toto what you have in the record but we will handle it in any way you would like to. We don't want to limit you in any way.

[The prepared statement of Dr. Ianniello follows:]

Statement of Louis C. Ianniello
Director, Division of Materials Sciences
Office of Basic Energy Sciences
Office of Energy Research
Subcommittee on Investigations and Oversight
of the
House Science and Technology Committee
May 13, 1983

Mr. Chairman and Members of the Subcommittee:

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Within the Department, these general facilities fall mainly under the management of the Office of Energy Research (OER) programs. The Office of Energy Research contains four major outlay programs: 1) the Office of High Energy and Nuclear Physics which supports several research facilities operating in a user mode primarily for university participants, 2) the Office of Magnetic Fusion Energy which supports certain facilities for their own programmatic objectives, 3) the Office of Health and

Environmental Research, and 4) the Office of Basic Energy Sciences (BES). This latter program has the greatest variety of interactions with industry and universities within OER. The BES program includes activities in materials sciences, chemical sciences, biological energy research, engineering, mathematics, geosciences, nuclear sciences, and advanced energy projects. I am the Director of Materials Sciences, the program where most of the major facilities are located, and I will provide some specific data on joint use related to that program, later.

The Department of Energy and predecessor agencies have had extensive experience in constructing, operating, and conducting research utilizing major research facilities. It is an important objective of the Basic Energy Sciences program to provide advances in the area of large, unique, high technology facilities important to energy and the nation's scientific and technological future. The nation's primary expertise in accelerator, nuclear reactor, laser and computer-based facility design lies in the Department's laboratories such as the two here in New Mexico, Los Alamos and Sandia. Over the years, researchers from all parts of the country and the world using these facilities have participated in scientific and technological experimentation of great benefit to mankind. Advancement of scientific knowledge and insights in the various fields of science related to energy is the principal reason for BES' continued involvement with large facilities. The availability of these unique facilities plays a large role in the United States world leadership in several fields of science such as radiation effects, neutron scattering, electron microscopy, and synchrotron radiation research.

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In recognition of their uniqueness, a number of the facilities have been designated as "user" facilities or "collaborative research centers." Their primary use is for the conduct of BES-funded energy-related research. However, the facilities have been made available to qualified scientists irrespective of their organizational association. The research to be done must be of documented programmatic interest to DOE, and must undergo rigorous review by members of the scientific community. The facility manager is expected to allocate the use of the facility in a manner that attains the maximum scientific quality and accomplishments. Where the results are to be published in the scientific literature, there will be no charge to the user for the operation of the facility. If a user wishes to do proprietary research, full cost recovery is required. A patent waiver, either blanket or individual, may be granted.

In order to make available to the community in general information on the major research facilities, the Office of Energy Research has published a number of documents listing the facilities together with their capabilities. The report DOE/ER-0139, "Office of Energy Research Major Facilities - Capsule Summaries" October 1982, is one such document and it contains a description of 25 of the largest OER facilities located in the Magnetic Fusion Energy, Basic Energy Sciences, High Energy Physics, and Nuclear Physics programs. Within BES, the major user facilities include: the High Flux Beam Reactor (HFBR) at Brookhaven National Laboratory (BNL), the High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory (ORNL), the Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory (ANL), the Pulsed Neutron Research Facility at Los Alamos National Laboratory

(LANL), the National Synchrotron Light Source (NSLS) at BNL, the Combustion Research Facility (CRF) at Sandia National Laboratory (SNL)-Livermore, the Stanford Synchrotron Radiation Laboratory (SSRL) at the Stanford Linear Accelerator Center, and the electron microscopy facilities at ANL, ORNL, and the Lawrence Berkeley Laboratory (LBL). The operation of these major facilities plus other minor ones requires over $40 million currently or over 15 percent of the BES operating budget.

I would like to take a moment now to summarize the use of the BES research facilities. As an example, I will use the Materials Sciences program facilities. We provide about $21 million to operate them, out of a budget of $108.7 million. The replacement cost for these facilities is estimated at $450 million. The Materials Sciences research funding around these facilities equals $16 million with another $11 million being attracted from outside Materials Sciences. Of the approximately 900 users of the Materials Sciences facilities, 21 percent are from DOE laboratories, 7 percent from other Federal laboratories, 48 percent from universities, 14 percent from industry, and 10 percent from foreign and other organizations. Of the research that is done locally by the host laboratories, 65 percent is supported by Materials Sciences and the remainder by other programs. Two other large BES facilities outside of the Materials Sciences program are the SSRL and CRF. The distribution of users at these two major facilities is: 39 percent from universities, 26 percent from industry, 24 percent from DOE laboratories, and 11 percent from foreign and other organizations. Thus, one can conclude from this information that there is a very significant use made of these facilities by non-DOE researchers whereby DOE has been able to leverage a much larger research program for the nation.

Of prime importance in all these interactions is the research output and usefulness of the facilities. One gauge of the usefulness is the extent to which the facilities are sought for research. We watch this carefully and presently find that all of the BES facilities have more users than can be reasonably accommodated within the facility operating schedule. Another gauge is the extent to which non-DOE organizations are willing to spend funds or time associated with the facilities. A few examples include: 1) industry has provided over $5 million to help equip the NSLS, 2) industry has been willing to pay for operating time at IPNS in order to keep the facility running longer, and 3) industry has recently provided the HFBR with $0.5 million to develop a neutron detector for general use.

With regard to technology transfer, the research facilities do serve as a major focal point for interaction among the university, industry, and DOE laboratory scientists. Often times experiments are conducted jointly. We believe this is the best way to enhance the transfer of technology--through the hands-on operation and intimate interactions possible at these facilities. The usual open literature publications, meetings, and workshops are also part of our continuing effort to transfer information and technology. In addition, each laboratory has a plan specifically tuned to their own situation for technology transfer. These have all been documented elsewhere, for example, the report of the Energy Research Advisory Board's Panel on the multiprogram laboratories.

The joint use of major DOE facilities by qualified researchers irrespective of their organization has not only enabled the DOE to acquire information faster, but has enabled the quality of the research to be maintained at the highest possible level.

A few examples of recent exciting research made possible by these facilities include: 1) the discovery of the coexistence of ferromagnetism and superconductivity made possible by neutron scattering experiments, 2) successful research using synchrotron radiation for x-ray lithography making possible the preparation of photoresists containing the circuit pattern with extremely small features useful for microelectronics applications, 3) successful use of synchrotron radiation to image constrictions in blood vessels, and 4) in-situ microscopy observations of materials while undergoing damage due to radiation.

Mr. Chairman, that concludes my formal statement. I would be happy to answer any questions you might have.

Mr. SKEEN. The next witness is Dr. James M. Williams, who is the Assistant Director of Planning and Analysis, Los Alamos National Laboratory, Los Alamos, N. Mex.

Dr. Williams, glad to have you here.

Dr. WILLIAMS. We are very pleased to have this opportunity to participate on your panel on this very important subject. Copies of my statement are available and I would just hit the high points of what is included in my statement.

Los Alamos National Laboratory has facilities which are valued at about $3 billion. That's the investment that the Department of Energy has made in our research and development facilities. Also, we have some 2,600 technical staff who are resources for the Nation and for the State. Over the years, we have become a less classified program than when we were in the early days, when our primary mission was the development of nuclear defense. And as time goes by, we have begun to interact much more with the surrounding community, with the technical community, and we are very happy to be involving ourselves more in interactions with industry.

I will describe three initiative areas that we're involved in for improving the communication that we believe is so important to making maximum effective use of the science and technology in which the Federal Government has invested at our laboratory. The first will be the laboratory-industry initiatives area. Then I'd like to talk about laboratory-university initiatives, and then, finally, I'll give you a brief sketch on our laboratory user facilities. In that $3 billion plant of ours we have many experimental facilities which we are trying to make available to others to use so that they don't have to duplicate such facilities.

The interactions between laboratories and the industry can take many forms. They can be anywhere from a strictly informal visit of people exchanging at the technical level to contractual relationships in which we do joint research. We are exploring all of these possibilities and increasing the amount of effort in these areas.

Some of the mechanisms we have used for developing a closer relationship with industry include performing reimbursable work in the laboratory where industry comes to the laboratory to have research done and pays the laboratory for its research. They then retain proprietary right to the research that is done there. This has not been done extensively in the past, but we are moving more in that direction, and this is one way of making that resource available and minimizing investment in the research facilities.

Second, we pursue participation in generic and technology research centers where industry has funded these centers. We try to participate as a partner. Third, we are trying in the area of northern New Mexico to help to establish a high technology industrial base as a local economic development factor in northern New Mexico. We also, as the laboratory, provide consultation services to industry. Now, in the past we have not done as much of this as we are doing now, but the staff of the lab has always been available for consultation. We encourage that. These are good examples of this cooperation.

We have been working with the Schlumberger-Doll Research Corp., in which we have used our abilities in hydrodynamic modeling simulators in our computers to help them to understand the complicated processes of fluid flow in porous media for removing oil from the Earth.

We have worked with Bolt, Beranek & Newman to provide the National Institutes of Health with a nucleic acid sequence data bank. The research in the biologic sense has led to a tremendous amount of very complicated data. The data needs to be readily available to researchers throughout the country so we are contributing in that area, working with industry.

We continue to work to reduce barriers that have caused us not to be able to have this closer relationship with industry. These barriers have included such things as legislation and policies on patents, copyrights, and ownership of the intellectual property. There has been improvement and DOE is working in that direction, and we're supporting it.

Our Patent Law Division at Los Alamos estimates that royalties of $3 million to $5 million per year would be generated if the ideas in the laboratory could be picked up and worked with industry and find their way out into the commercial use. But we have to overcome these barriers in order to make that happen. This is a factor, I think, in reducing the total cost, if you will, of research.

Now, in the second area—laboratory-university initiatives—I would like to hit a couple of high points. We really believe it's important to develop strong relations with university, State government, and industry. Over the years, Los Alamos has maintained a strong relationship with the University of New Mexico in two primary ways. In the educational aspect, we have provided staff from the laboratory as professors in some of the courses at the university. In addition, we have pursued joint research projects where students from UNM come to Los Alamos and do research in some of our facilities.

Another area that we support strongly is the work done by the Governor's Committee on Technical Excellence and, in particular, we commend the State support of the recommendation to establish

a Rio Grande research corridor, a high tech corridor. We have been collaborating in two significant areas in this high tech corridor.

In a $3.3 million program at UNM to develop a center in laser optics, microelectronics, and innoninvasive technology in medical diagnostics, we are working in the area of lasers and modern optics and nuclear magnetic resonance imaging.

At New Mexico Tech, there is a $1.3 million program to set forth a center for explosives technologies. Los Alamos has experience there, and we are collaborating with NMSU.

We are also supportive of the statewide technology innovation centers which are being developed at UNM and NMSU and throughout the State. Considerable interaction does occur between the laboratory and UNM. For example, we have had more than 100 students and professors coming to the laboratory, and we have 58 different projects that benefit from the cross-fertilization of ideas between the laboratory and UNM.

Finally, let me shift to the subject of user facilities. We are now working both with industry and with universities in order to provide in general fee-free access to many of our research facilities, and I have here a handout—it's available also for the public—the Los Alamos National Laboratory user arrangements and fees document, which you might find interesting. One good example of this kind of an arrangement is the Los Alamos Meson Physics Facility. To give you an idea of the kinds of arrangements we make there, what we do is we have research proposals from everyone throughout the country, international proposals, as well as in the laboratory. An advisory committee comprised of internal and external people reviews these proposals and decide which of the proposals are the best research and the best utilization of the research facility. We sometimes make available electronic instrumentation, such as magnets and cryogenics, and engineering support to help researchers when they come in. We also have data acquisition facilities to provide for data reduction and understanding of the experiments. And in general, as long as the output, as Lou has said, is publishable research these facilities are provided on the basis of no fee to the user.

We believe that through communication and better understanding of what the Nation's resources are, such as the Los Alamos National Laboratory, we will be able, just from that communication and information, to see where there are facilities available that might otherwise be built by someone not knowledgeable of their existence, and thereby reduce the cost to the Nation of the new research facility. By communicating our interest in participating and making available our facilities, we believe this is one way to reduce costs to the Federal Government and to the Nation as a whole of doing our deed that can lead to innovative and productive commercial products.

Finally, I would like to say the laboratory director has made a firm commitment to make these things happen. That's a very important thing. If the leader of an institution, if the leaders in the country want to make this happen, it will happen. To show that this is important, Don Kerr has established an office reporting directly to him—the Office of the Assistant Director for International and Industrial Initiatives. Their major focus is to forge relations

and to strengthen industry, university, and laboratory activities to our mutual benefit. So we intend to build on these interactions both with State and local governments, with the universities, and with industries. And we believe that it will be of benefit, mutual benefit to the laboratory, to the State, to industry, and to universities.

[The prepared statement of Dr. Williams follows:]

STATEMENT OF DR. JAMES M. WILLIAMS, ASSISTANT DIRECTOR FOR PLANNING AND ANALYSIS, LOS ALAMOS NATIONAL LABORATORY, BEFORE THE INVESTIGATIONS AND OVERSIGHT SUBCOMMITTEE OF THE HOUSE SCIENCE AND TECHNOLOGY COMMITTEE, LAS CRUCES, N. MEX., MAY 13, 1983

INTRODUCTION

The health of U.S. advanced technology industries and their international competitive vigor are central issues in current trade and economic policy debates. The United States, like its major industrialized allies, views the ability to generate and use advanced technologies as essential, both to national economic well-being and to military strength. Several governments, most notably France and Japan, have designed comprehensive national policies to help promote successful technology and trade development in major sectors such as computers, telecommunications, microelectronics, biotechnology and aerospace. The United States currently does not have a clearly defined industrial policy, although discussion and debate over the merits of developing such a policy are being heard in many forums from the halls of Congress, to national laboratories and private research and industrial firms.

Growing national concern over U.S. competitiveness in the international high-technology market place appears to be warranted by the facts. Although the U.S. currently holds the highest market share of the industrialized countries' exports of high technology products, that share declined from 30 percent in 1962 to 22 percent in 1978 and has increased only marginally since. In contrast, Japan's high technology trade balance during the same period (i.e., 1968-1980), increased two-hundredfold.

Even though there is a lack of consensus on how the United States can best channel its resources for the new technological revolution, the State of New Mexico has a unique opportunity to forge a new and vigorous role for technology development. Los Alamos National Laboratory is taking an active part, in conjunction with industry, universities and the State Government to define and develop this new role. Among the topics which this testimony will address are Laboratory-Industry Initiatives, Laboratory-University Initiatives and Laboratory User Facilities.

LABORATORY-INDUSTRY INITIATIVES

The role of Los Alamos is beginning to markedly broaden with respect to technical collaboration with industry, universities and government. On January 3, 1983, Los Alamos issued the "Revised Report of the Laboratory-Industry Technology Initiatives Committee," which points out the benefits of increased Laboratory-industry interaction, both to help ensure that the U.S. economy can take full advantage of Laboratory technology and to strengthen its internal scientific and technical expertise and applied programs. These interactions can take many forms, from strictly informal visits by representatives from industry and universities to more formal contractual relationships for sharing the benefits of joint research. As a result of the Laboratory-Industry Technology Initiatives Committee Report, the Laboratory's senior management has developed a policy to encourage greater collaboration with industry, based on the understanding that strengthened, coordinated interactions are in the long-term best interest of the Laboratory. Some of the mechanisms for developing closer relationships with industry indicated in the report are as follows:

- The Laboratory will place emphasis on performing reimbursable work for industry, when it clearly benefits the Laboratory technically through maintenance or strengthening of its core expertise or through directly transferring its technology to industry, particularly when it constitutes a joint or collaborative program.

- The Laboratory will pursue participation in, or initiation of, generic research and technology centers or programs supported by industry consortia or individual firms or partnerships.

- The Laboratory will continue its interest in efforts to establish a high-technology industrial base in its vicinity, including selective encouragement of appropriate spin-offs to new or existing industry, and continued cooperation with the University of New Mexico's Technical Innovation Center.

- The Laboratory will provide consultation services to industry; this is not intended to replace or discourage individual consulting by the staff, which should continue.

We expect that increased collaboration will provide American industry advantages which are similiar to the Laboratory's, i.e., opportunities to use existing Laboratory technologies and to have access to its unique expertise, capabilities and facilities; and increased opportunities to seek government contracts with the Laboratory as a potential collaborator.

An expanded Laboratory-industry relationship is already showing tangible results. The Laboratory is establishing a collaborative research project with Schlumberger-Doll Research Corporation to further knowledge of multiphase flow for oil extraction in the presence of vortices. This theoretical flow description will provide analytical capabilities for numerous fluid flow problems at both Schlumberger-Doll and Los Alamos. The collaboration benefits both institutions through the collateral exchange of ideas and expertise.

In another collaborative effort, the Laboratory has begun work on a subcontract from Bolt, Beranek and Newman to provide data for a National Institutes of Health (NIH) Nucleic Acid Sequence Data Bank. The project responds to a clear need in the molecular biology community for management of the rapidly growing body of data on DNA sequences. This program is noteworthy for several reasons. The Laboratory first suggested this program to the NIH in 1979. NIH made an open solicitation for proposals, following which two companies approached the Laboratory separately to team with them in a proposal.

Because it was inappropriate for the Laboratory to choose one company with which to team, a proposal for our part of the work was supplied to the NIH and to both companies. The companies incorporated it into their proposals. Laboratory collaboration with industry is a necessary part of obtaining this work, because the administration of the data bank, collection of users' fees and dial-up service

required are obtained most appropriately from industry. The Laboratory will collaborate not only with Bolt, Beranek and Newman on the data bank, but also with important contacts in the molecular biology community. The data obtained from this collaboration will enrich the technical base.

Los Alamos has also been working to reduce barriers which have hindered closer Laboratory-industry collaboration. A major obstacle to increasing collaborative efforts between national laboratories and universities and industry has been archaic legislation and policies dealing with patents, copyrights and intellectual property. Los Alamos has been working within existing legislation and DOE policies to lessen these obstacles to technology transfer and has suggested specific changes, clarifications or expositions of policy which would contribute to a stengthening of the technology transfer process in the licensing area.

Our Patent Law Division estimates that royalties of $3 million to $5 million per year could be generated by a mature patent marketing and licensing operation that had full authority to negotiate exclusive and non-exclusive licenses to patents developed at Los Alamos. Among the past, major Los Alamos innovations contributing to this royalty stream could have been the heat pipe and the flow cytometry system. Newer innovations that could contribute in the future include several inventions in magnetic refrigeration and a wristwatch radiation dosimeter. This estimate does not include income that might be generated by licensing of unpatented technology or computer software.

It should be noted that the lack of an effective licensing program may have cost the Nation some important scientific innovations (or at least a significant time lag in their discovery) because there have been no substantial incentives for need-driven or opportunity-driven innovation within the National Laboratories. Despite existing restrictions, the Code of Federal Regulations contains provisions by which an inventor can petition DOE for a waiver of patent rights in his invention. If the petition is granted, the Government retains certain rights, but the inventor is given the right to privately patent and commercialize his invention. Our inventors can benefit from this type of waiver, especially those who have developed contacts with industries in the particular field of their

invention and those who--in addition to their Laboratory employment--maintain a private business. Waivers have been granted to Los Alamos employees on a number of inventions.

A major drawback for an inventor to apply for a waiver has been the long processing time which DOE has taken to approve or disapprove a waiver application. Los Alamos is working with DOE to streamline the waiver application process.

An industrial firm or university may obtain from DOE an advance waiver of title to patents arising from the sponsored research when it pays the full cost of the research. Proprietary rights in data generated in such research may be negotiated.

LABORATORY-UNIVERSITY INITIATIVES

If the vision of a more prosperous New Mexico is to be achieved, all of the economic and intellectual resources of the State must be more fully developed and coordinated. Consequently, Los Alamos recognizes the importance of developing closer relationships with universities, State government, and industry, and we have begun to explore ways to enhance relationships with these institutions.

Our broad goal for Laboratory interactions with the University of New Mexico (UNM) is to foster contacts, communications and collaboration to our mutual benefit. Activities fall into two major categories: educational, and research and development.

Educational objectives are to provide Laboratory staff expanded opportunities for professional development while, in turn, utilizing Laboratory staff to strengthen UNM's educational offerings. Twenty-four Laboratory staff members have served as adjunct professors at UNM and others serve in an advisory capacity on committees governing University curriculum and facilities.

The Laboratory was an active participant, along with university representatives, in the Study Group appointed by the Governor's Committee on Technical Excellence that prepared the report, "Enhancing New Mexico's Leadership

in High Technology Industry Development." The report, which was released in late September 1982, proposed a Rio Grande Research Corridor, focused on areas of technical excellence at State universities in the Corridor, and suggested how the further development of New Mexico industry could encourage desirable technologies compatible with those already existing in the State. Los Alamos commends and supports the State Government's acceptance of the Report's recommendation to establish a Rio Grande Research Corridor. The State Legislature's appropriation of $7 million to fund centers for technical excellence at UNM, NMSU and NM Tech is a further indication of the State's willingness to initiate steps which are essential if New Mexico is to become competitive with other states in attracting high technology industries. The following are areas in which Los Alamos collaboration is significant in the development of these technical centers:

- $3.3 million to UNM for centers of excellence in laser optics, microelectronics and non-invasive technology in medical diagnostics. (Los Alamos collaboration is in laser and modern optics and Nuclear Magnetic Resonance (NMR) imaging for non-invasive medical diagnostics).

- $1.3 million to NM Tech for a center in explosives technologies. (Los Alamos collaboration is in explosives applications, including development of an industrial park).

In addition to the above initiatives, the Legislature has appropriated $600,000 to create a statewide Technology Innovation Center with centers at UNM and NMSU and liaison offices in Portales, Las Vegas, Silver City, Portales and Socorro. The purpose of these centers is to help local inventors develop and market their ideas. The center at UNM has operated for several years on shoestring support until this appropriation was passed. It uses UNM faculty and graduate-class projects to provide potential entrepreneurs with technical evaluations, market surveys, business plan preparation, and assistance in finding financial backing. In return, the Center receives equity in the venture, both reducing up-front costs to the entrepreneur and providing income to the Center. With the appropriated funds, the satellite centers, which will be established at the other universities will be able to handle a much larger client load.

Los Alamos provides referrals for potential Laboratory entrepreneurs to the Center and has assisted the Center on patent and other issues. A Laboratory representative is also on the Board of Directors of the Center.

Considerable interaction occurs between the Laboratory and UNM in the area of research and development. In a recent Laboratory survey (April 1983), the Laboratory's technical divisions were polled to assess the magnitude of the interaction as well as the major research areas. The level of involvement ranges from undergraduate research assistants to visiting scientists. Over the last 18 months, more than 100 UNM students and professors have worked with Laboratory staff. While it is impossible to estimate the number of Laboratory staff involved, it probably approaches three to four times the UNM total.

Research collaboration is as broadly based as is the expertise at the Laboratory. Currently, 56 different projects are benefiting from the cross-fertilization of ideas between the Laboratory and UNM. Some of the most notable of these interactions include joint efforts in the development of non-invasive medical diagnostic techniques using Nuclear Magnetic Resonance imaging; joint research projects that will lead to better patient care for New Mexico residents having cancer or diabetes; collaborative efforts in alternative energy research, notably solar, geothermal and synthetic fuels; and basic physics research using LAMPF facilities to name just a few.

Our efforts with the University in the areas of education and research and development have been fruitful and, we believe mutually beneficial. We look forward to expanding these efforts in the future.

USER FACILITIES

Another way in which the Laboratory is working with both universities and industry is by providing generally fee-free access to many of Los Alamos' research facilities. Los Alamos has numerous specialized facilities and support technologies, such as computer software, which constitute, in many cases, rare or

one-of-a-kind facilities in this country. The "Los Alamos National Laboratory User Arrangements and Fees" list has just been completed, and I would like to submit it for the record so that interested parties may become more aware of our facilities. The Laboratory has made a commitment to a broad range of scientific collaboration with universities and industry. One aspect of that commitment is to provide access to many of its facilities. Both collaborative and independent research are encouraged on either dedicated users' facilities or on other facilities when they can be made available without interfering with programmatic work. Collaboration is also welcomed in most unclassified projects at the Laboratory.

The Los Alamos Meson Physics Facility (LAMPF) is an example of a major, dedicated user facility. Generally, there have been no users' fees and the arrangements for its use are illustrative:

- Research proposals are reviewed and rated by an external program advisory committee. Experimental beam time is scheduled by a LAMPF committee.
- Electronic instrumentation, some magnets, cryogenics, and engineering support are available for approved experiments.
- Data acquisition and analysis facilities are provided by the Laboratory.

In addition, the National Flow Cytometry Resource, the National Stable Isotope Resource, and the Weapons Neutron Research Facility have generally charged no users' fees for accepted research programs.

CONCLUSION

I have discussed a variety of interactions and initiatives which Los Alamos has undertaken to enhance its collaborative relations with industry, universities and government. The Department of Energy, both in its policies and its actions, has been supportive of our efforts.

Discussions have recently been initiated between the State Department of Commerce and Industry and the Laboratory to more clearly define ways in which each may be more mutually supportive of each others' goals and in collaborative efforts which will strengthen support for achieving the broad goal of enhancing the environment for further development of advanced technology industries in New Mexico. Greater benefits can result and be shared by all involved parties if policies and plans are developed thoughtfully and carefully.

The important commitment of the Laboratory is in the belief that collaborative interactions with industry, with universities and with state and local governmental bodies encourage a partnership of interests. It is how well this "partnership of interests" is defined and implemented that will determine the success of advanced technology development in New Mexico. In an even broader sense, how well the "partnership of interest is defined at the national level will also play a significant role in how quickly and how well the United States improves its competitiveness for advanced technology products in international markets.

The types of cooperative interactions which I have discussed can provide an effective mechanism by which technology can be transferred to industry from the Laboratory. They serve to encourage the commercialization of technology resulting from federally funded research.. In that sense, the taxpayer benefits in numerous ways. The cost of running federally supported research facilities will be reduced through the sharing of information, personnel and facility use with industry and universities to an extent which could be unprecedented in our history during peacetime. There may even be some unforeseen economic benefits, such as the phasing out of programs or the closing of antiquated federal or private facilities where unintentional duplication or overlapping research efforts have been occurring without the benefits of interactions with other institutions. The greatest benefit of all will occur if the policies of governments, national laboratories, university and industrial research facilities can be coordinated in ways which result in an improvement in national productivity and a strengthened U.S. economy in which we retain our role as technological innovators and increase our share of emerging international markets for advanced technology products.

The Laboratory has made great strides not only in developing a viable implementation plan but also in taking the initiative to set that plan into motion. The Laboratory Director has made a firm commitment to "make it happen." He has established an Assistant Director for International and Industrial Initiatives whose major focus will be forging and strengthening new industry-university-Laboratory interactions of mutual benefit. Internal Laboratory policy is evolving to facilitate the pursuit of entrepreneurial endeavors by Laboratory staff. And, the procedures for initiating collaborative efforts by scientists, as well as the patent policy, are being simplified.

The Laboratory intends to build on the fruitful interactions we have had for the past four decades with universities, government agencies, and some industries. These efforts have great potential for success; and, if successful, they can be of enormous benefit, not only to the Laboratory, university, or industry involved, but to the State of New Mexico and to the entire Nation. Joint utilization of our facilities by university and industry might well help to reduce operating costs but, more importantly, it would accelerate the technology transfer process and increase the innovation and productivity this nation needs to successfully survive the new technological revolution.

Mr. SKEEN. Thank you very much, Dr. Williams. That was very good testimony, and we appreciate having you.

Before I go any further, I would like to take this opportunity to also introduce to you the members of the staff. These are the folks that do all the back-breaking work that it takes around Congress to put these kinds of hearings together, to make sure that they are focused in the right direction, and background information is available, and I think that they deserve a lot of appreciation from those of us who are in Congress because they make us look good sometimes, if we are not doing at all well otherwise. You have had those kinds of days, too. Bob Nicholas, who is majority staff leader on Investigations and Oversight Subcommittee, is here on the right.

Bob, thank you so much.

Don Rheem on my left is minority staff leader. And we have got two other members—one from minority and one from majority—who are upstairs working. And that's Jim Jensen. And I would like to mention them. And also on my staff, Bob Lamina.

So I just want you to know how much we appreciate the work that you folks do. Besides that, they kind of enjoy this. They come down here and they get to come down in advance of the Members of Congress so that they can establish some kind of credibility with the natives, cultural exchange. So thank you very much.

Harry Wugalter, we would like very much to hear from you.

Mr. WUGALTER. Congressman Skeen, Congressman Durbin, thank you for your invitation to offer testimony on the value of cooperative research relationships with industry and universities. I am Harry Wugalter, manager of Communications at the Rockwell International Corp. Science Center. We are located in Thousand Oaks, Calif.

Our laboratory covers a number of technical areas—structure, physics, chemistry, mathematics, electronics, business, and processing. Research is dedicated to our corporation, and we provide corporate research support to our aerospace, electronics, automotive, and general industry and businesses.

We employ over 100,000 in our national and international operation. Perhaps the most important ingredient necessary to create a worthwhile relationship is to identify objective. In our experience, we have found that unless we know precisely what we intend to do, we are fantasizing. It is essential to have a well-defined understanding as to how each organization can contribute time, effort, and talent to reach a goal that is mutally beneficial. Therefore, it is necessary for the interest of participants to learn of each other's capabilities.

To digress, and as an aside, I handle the liaison fellowship so I am very familiar with our institute. Certain schools can research things very well, others cannot; and it takes years to build the type of staff and the potential to meet particular objectives. We have been exploring many ways, and recently, with our Los Alamos Laboratory in New Mexico, we have had visitations. We have sent some of our best people to explore areas of interest between the two organizations. It's not the workshop Congress. It's the one-on-one approach that's significant.

We have developed a firm commitment to establish a broad range of technical collaboration with the laboratory, universities, and industries. And this interchange in Los Alamos was necessary to acquaint potential participants with what is available. A lot of what is available you do not know about, nor are some classified items available to too many people. However, there can be some recital benefit, and we have to be able to examine it. Thirty days after this initial effort, a technical party from Los Alamos visited our center and received briefings that offered a comprehensive view of our activities. And even though they read all of the journals, they were not aware as to what is happening because of the proprietary and business relationships.

Now that contact has been made, now that we have contact, it is anticipated that scientists from both sectors with particular interest will begin to utilize the available expertise for possible collaboration or joint ventures. The initial purpose has been accomplished. Now specific goals have to be established as mutual interest draws people together.

We enjoyed our visit to Los Alamos, and we are looking forward to some very strong collaboration because of this. But if you pass a law and say, "You have to do it," it is not going to do it. It has to be people who have this mutual interest. I am going to give you some other evidence of what has been done in the past to show how relationships have been conducted successfully.

INDUSTRY AND UNIVERSITIES

In 1976, Rockwell International Corp.'s Science Center initiated work on an innovative program as one of several activities undertaken as part of Rockwell's commitment to increasing the number of minority individuals in high technology careers. We knew that

the perimeters were shrinking. We could scout the South and do reconnaissance. We couldn't afford to lose anyone, and, therefore, we had to develop a program to bring other people to the mainstream of technology. So, we set a goal. The goal was to increase the number of minority students holding advanced degrees in solid-state electronics so that their talents could be utilized in a field of great importance to both industry and to society as a whole. We selected Howard University and North Carolina A&T State University for a joint industry-university program for a purpose—to help overcome the underrepresentation of blacks with B.S. degrees in science and engineering. We set a goal.

In the original planning for the 3-year joint industry-university program, the science center personnel determined that the key element in meeting the goal of increasing minority participation in advanced high technology education was to establish a viable engineering research program. Without that, no one is going to come to your school. Supported by a strong faculty, outstanding students, well-equipped laboratories, and a significant research program. How do you do that?

Rockwell International's Science Center transferred to Howard and North Carolina A&T, which have predominantly black enrollment, one of our key solid-state electronics technologies—gallium arsenide materials and devices—to assist in establishing a strong research program to serve as a basis for an advanced degree program in electrical engineering. You just don't give them the technology. You have to give them support.

As added support, the science center subcontracted some of its technical work that you just heard mentioned here to the two unviersities to help provide a sound base for the research effort and to utilize the universities' research.

They got the research; they got advanced technology; they learned there is something called entrepreneurship; they learned that it has to be applied; they learned you have to have good faculty and good staff. You had to give them something first—an idea that nobody else had.

Rockwell also provided other resources. They needed equipment, capital equipment. We didn't give them surplus equipment that was antiquated and obsolete. This was state of the art technology. You need the best equipment. We gave them support in the laboratory design layout and construction. They wanted to know: How do you build a laboratory? Well, we have quite a few laboratories. We gave them support—layout, construction, assistance in installation and activation of the equipment, and aid in developing the research programs at the universities.

Under Rockwell sponsorship, Cornell University assisted in execution of the program. Another institution that said, "What are you fellows doing over there?" And Cornell got interested. They provided the academic perspective necessary for the rapid establishment at both A&T and Howard of an enriched master's degree program which could be developed into a Ph. D. program in minimum time. Cornell has an outstanding department of electrical engineering in which the GaAs technology is well established.

In significant measure, as a result of this effort, Howard established a Ph. D. program which started with nothing and went from

B.S., M.S., a Ph. D. program in engineering, which North Carolina A&T has developed into a strong master's degree program in electrical engineering.

Modern solid-state electronics research laboratories were completed at both schools during 1977, and both universities made signficant progress in solid-state electronics materials growth and device fabrication and characterization early in the program. At A&T, emphasis is on research in opto-electronic devices, principally solar cells; while at Howard, the program is centered around microwave devices. Rockwell International saw a need to establish an objective and supported the program. Incidentally, when you sent me your little booklet that came with the invitation, The University-Industry Fourteenth Annual Report of the National Science Board, they cite this very program. I didn't know you were going to send the book. Thank you. They call it a unique pioneering cooperative venture between the government, industry, and universities. I want to give you another example of what can be done if you want to do it bad enough.

INDUSTRY AND BRANCH COLLEGES

That's very important. Not everybody is going to be a Ph. D. A lot of people want to work in high technology, that only need a 2-year degree. On January 31, 1978, in his presentation to the Amigos De Ser in Washington, D.C., the chairman of our board, Robert Anderson, reviewed the corporation's efforts to improve employment opportunities for minorities and assistance provided at the two black colleges I just mentioned. He then followed with "Our next goal is to establish a similar program directed at Hispanics and native Americans." Once again, an objective was developed and liaison established with this school, New Mexico State University.

In this case, the science center intended to utilize its nondestructive testing technology—once again, we were going to use the same technique. What is it we are doing that we are good at, that we can give to the school, that we know the school would accept? In this case, we intended to utilize the nondestructive testing technology that we had been handling for 9 years under a DARPA contract, as you are aware of, to introduce noncollege-bound students to career opportunities in the shortest period of time. We selected the Alamogordo Branch College of NMSU.

The university president, Dr. Thomas, and the executive vice-president, Dr. Roush, recognized the potential of such an opportunity, as it was apparent that manufacturing techniques, expanding requirements for high reliability in aircraft and energy production systems would place an increasing demand on early economical and nondestructive detection of flaws or defects in materials. With their support, this project—involving industry, academia, and State government—is a successful program. Today the program is an integral part of New Mexico State University's associate degree program at the Alamogordo branch and is graduating its second class of skilled technicians who are very, very much in demand.

Now, I presented three examples of industry-university-national-laboratory activities. One, Industry working with a laboratory; two,

industry working with a university; and three, industry working with a university branch. They were selected from many. I have a lot of items, but I didn't want to plague you with too many.

We support this Southwest Research Center for Science and Engineering. We sent them surplus equipment for the kids for their Saturday morning science academy. That is involved because you have to get the element in the secondary grades to interest young people early and, too, we provide cash so we can cover their lunches, their transportation costs. We have provided funds for notable areas in both elementary and secondary, as well as the MIT in the world. We go all the way down.

However, these examples I gave intend to focus upon the need to fully understand the purpose of the joint relationship prior to the establishment of an approach in order to assure the participant of long-term gain. It is very, very important to know where you're going, and not just shotgun and darkness. You don't know where you're going.

The Rockwell International Science Center is also familiar with the Rio Grande Research Corridor Report. Dr. Peter Cannon, vice president—research for our corporation, serves on the industry advisory group that is involved in the development phase of this approach. The science center is currently participating in the technical planning effort. A member of the technical staff, Ora Smith, is working with the New Mexico group to develop all kinds of network design plans linked along the Rio Grande Research Corridor. We are good at avionics and we are good at communications. We own Collins Electronics.

Therefore, we were able to send some of our people, look it over, and give the advice and counsel as an advisory group as to what we think is necessary in the development of the type of system that we propose.

The data highway concept was introduced to enable shared use of computers, teaching aids, computational hardware/software and telecommunications in the corridor—and this is important. Once again, there has to be an objective. We just don't want to talk to each other up and down the line. We want to use the hardware. This capability—now we're getting down to what I think is the most significant part—this capability should serve as a tool and make state-of-the-art technology at national laboratories available to educational users, researchers, and, most importantly, gentlemen, as possible incentives for potential businesses considering ventures in the State that require CAD/CAM, computer-aided design, computer-aided manufacturing. A small business can never afford to purchase that sophisticated equipment, but they might be interested, if they had access to utilizing it in their manufacturing and their design processes.

I'm sure that you will be receiving a much more comprehensive report from one of the initiators of the Rio Grande Research Corridor concept, Art Snyder, from Sandia National Laboratory, who has done an outstanding job on this project.

In conclusion, your committee is to be complimented for its examination of joint use of federally supported research facilities by industry and universities. Perhaps with a strong industrial collaborator who is comfortable in the marketplace, the talent available at

national laboratories can be utilized to develop a more favorable economic climate for New Mexico and the Nation. It is apparent that far too many graduates from New Mexico schools have to leave the State for economic reasons—and I can cite that with my own child. It's interesting, Congressman Skeen, that all of our kids that have graduated from the classes are all flying to Utah, Houston. No one is working in the State. They all got their education here, but they are in Houston, Salt Lake, and other areas. It is apparent that too many of our students have to leave the State.

So I hope that the bottom line of all of the reports you hear and subsequent activities will be job opportunities somewhere along the line for New Mexico for such talented people.

Thank you. I would submit to questions.

[The prepared statement of Mr. Wugalter follows:]

TESTIMONY - FIELD HEARING
INVESTIGATIONS AND OVERSIGHT SUBCOMMITTEE
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES
LAS CRUCES, NEW MEXICO, MAY 13, 1983

Congressman Skeen, honorable members of the committee and staff, thank you for your invitation to offer testimony on the value of cooperative research relationships with industry and universities. I am Harry Wugalter, Manager of Communications at the Rockwell International Corporation Science Center, located in Thousand Oaks, California. Examples, illustrations and perceptions are linked to recent Science Center activities that bear upon the topic.

The most important ingredient necessary to create a worthwhile relationship is to identify an objective. It is essential to have a well-defined understanding as to how each organization can contribute time, effort and talent to reach a goal that is mutually beneficial. Therefore, it is necessary for the interested participants to learn of each others capabilities.

INDUSTRY AND NATIONAL LABORATORIES

Recently, technical representatives from our laboratory visited the Los Alamos National Laboratory to explore areas of interest between the two organizations. Los Alamos National Laboratory has developed a firm commitment to establish a broad range of technical collaboration with American industry and this interchange was necessary to acquaint potential participants with what is available. Thirty days later a technical party from Los Alamos visited the Science Center and received briefings, tours and other presentations that offered a comprehensive view of our activities. Now that contact has been made it is anticipated that scientists from

both sectors with particular interests will begin to utilize the available expertise for possible collaboration or joint ventures. The initial purpose had been accomplished -- now, specific goals will have to be established as mutual interest draws people together.

INDUSTRY AND UNIVERSITIES

In 1976, Rockwell International Corporation's Science Center initiated work on an innovative program as one of several activities undertaken as part of Rockwell's commitment to increasing the number of minority individuals in high technology careers. The goal was to increase the number of minority students holding advanced degrees in solid state electronics so that their talents could be utilized in a field of great importance to both industry and to society as a whole. Howard University and North Carolina A&T State University were contacted and selected for a joint industry-university program to help overcome the under-representation of blacks with B.S. degrees in science and engineering.

In original planning for the three-year joint industry-university program, Science Center personnel determined that the key element in meeting the goal of increasing minority participation in advanced high technology education was establishment of a viable engineering research program, supported by a strong faculty, outstanding students, well-equipped laboratories and significant research programs.

Rockwell's Science Center transferred to Howard and North Carolina A&T, which both have predominantly black enrollment, one of its key solid state electronics technologies -- gallium arsenide (GaAs) materials and devices -- to assist in

establishing a strong research program that served as a basis for an advanced degree program in Electrical Engineering.

As added support, the Science Center subcontracted some of its technical work in the technology to the two universities to help provide a sound base for the research effort and to utilize the universities' research.

Rockwell also provided other resources, such as capital equipment, most of which was purchased new; support in laboratory design layout and construction; assistance in installation and activation of the equipment and aid in developing the research programs at the universities.

Under Rockwell sponsorship Cornell University assisted in execution of the program, providing the academic perspective necessary for the rapid establishment at both A&T and Howard of an enriched master's degree program which could be developed into a Ph.D. program in minimum time. Cornell has an outstanding Department of Electrical Engineering in which the GaAs technology is well established.

In significant measure, as a result of this effort, Howard established a Ph.D. program in Electrical Engineering, while North Carolina A&T has developed a strong master's degree program in Electrical Engineering.

Modern solid state electronics research laboratories were completed at both schools during 1977, and both universities made significant progress in solid state electronics materials growth, and device fabrication and characterization early in the program. At A&T, emphasis is on research in opto-electronic devices,

principally solar cells, while at Howard the program is centered around microwave devices. Rockwell International saw a need, established an objective and supported this program. This model was recently cited in the University-Industry Research Relationships, Fourteenth Annual Report of The National Science Board (page 30) as "A unique pioneering cooperative venture between Government, industry and universities..."

INDUSTRY AND BRANCH COLLEGES

At his January 31, 1978 presentation to the Amigos De Ser in Washington, D.C., Robert Anderson, Chairman and Chief Executive Officer of Rockwell International, reviewed the Corporation's efforts to improve employment opportunities for minorities and assistance provided to two black colleges. He then followed with "Our next goal is to establish a similar program directed at Hispanics and Native Americans." Once again, an objective was developed and liaison established with New Mexico State University.

In this case the Science Center intended to utilize its nondestructive testing technology as a means to introduce non-college bound students to career opportunities in the shortest period of time via the Alamogordo Branch College of NMSU. The University President, Dr. Thomas and the Executive Vice President, Dr. Roush recognized the potential of such an opportunity -- it was apparent that manufacturing techniques, expanding requirements for high reliability in aircraft and energy production systems would place an increasing demand on early, economical and nondestructive detection of flaws or defects. With their support, this project, involving industry, academia and state government is a successful program. Today, the program is an integral part of New Mexico State University's associate degree

program at the Alamogordo Branch and is graduating its second class of skilled technicians who are in demand.

I presented three examples of industry-university-national laboratory activities. These are selected from among many. However, it is intended to focus upon the need to fully understand the purpose of the joint relationship prior to the establishment of an approach in order to assure the participants of long-term gains.

The Rockwell International Science Center is familiar with the Rio Grande Research Corridor Report. Dr. Peter Cannon, Vice President-Research, Rockwell International serves on the industry advisory group that is involved in the development phase of this approach. Further, the Science Center is currently participating in the planning effort. A member of the technical staff, Ora Smith, is working with the New Mexico group to develop a comprehensive network design plan relative to the proposed information link along the Rio Grande Research Corridor. The data highway concept was introduced to enable shared use of computers, teaching aids, computational hardware/software and telecommunications in the corridor. This capability would serve as a tool and make state-of-the-art technology at national laboratories available to educational users, researchers and as possible incentives for potential businesses considering ventures in the state that require CAD/CAM.

I'm sure you will be receiving a much more comprehensive report from one of the initiators of the Rio Grande Research Corridor concept, Art Snyder from Sandia National Laboratory.

In conclusion, your committee is to be complimented for its examination of joint use of federally supported research facilities by industry and universities. Perhaps, with a strong industrial collaborator who is comfortable in the marketplace, the talent available at national laboratories can be utilized to develop a more favorable economic climate for New Mexico and the nation. It's apparent that far too many graduates from New Mexico schools have to leave the state for economic reasons -- I hope the bottom line of all of the reports and subsequent activities will be job opportunities in New Mexico for such talented people.

Respectfully submitted,

Harry Wugalter
Manager
Communications & Academic Affairs

Mr. SKEEN. Thank you very much. I think you have brought this thing, once again, as all of you have, into focus, particularly from the industrial side of the issue, the private sector. And thank you so much for very significant testimony.

Now we have the Honorable Dr. Bill Stephens, who is the Secretary of Agriculture for the State of New Mexico. Bill, thank you so much for being here today.

Dr. STEPHENS. Thank you, Congressman Skeen, Congressman Durbin. We even have a Secretary of Agriculture from Illinois, Secretary Block, who is a good friend of mine. We are glad to have Harry Wugalter. He and I were on Governor Apodaca's cabinet.

Congressman Skeen, I do appreciate an opportunity to visit with this group. I am the Director of the New Mexico Department of Agriculture, and by virtue of that position, I am automatically the Secretary of Agriculture so in that capacity, I would like to visit with this group today.

There is no question in my mind as to the desirability of intensifying and refining supported facilities. In order to understand the significance and ramifications of this issue, it is imperative to fully appreciate the central role research plays in the cultural vitality and productive success of American agriculture. The extraordinary productivity and efficiency of the agricultural industry must be attributed in large part to the fruits of concerted research.

Yet these research successes are not the exclusive domain of any single sector, be it a university, government, or industry. Research both transcends and incompasses these areas. In light of this inherent interdependence, there are signficant benefits to be derived from close cooperation, including the joint use of existing facilities. It is encumbent upon all of us to garner the necessary resources to insure an effective national policy toward research. In this regard,

we should carefully consider the statement appearing in the 14th Annual Report of the National Board of Science, National Science Foundation, which says: "This report starts from a conviction that the health, welfare, and defense of our society are directly, and not at all mysteriously, related to the strength and vigor of our science and research capabilities."

One means of insuring this strength and vigor is to increase utilization of existing federally supported facilities through joint use. This type of sharing is even more reasonable and favorable when it is realized that if this cooperation were not to occur, many federally supported facilities would experience even greater underutilization of available capacity.

The magnitude of this problem of underutilization is illustrated, in part, by the January 14, 1983 General Accounting Office report entitled "Federal Agricultural Research Facilities Are Underused." As the report states—and I quote—"The use of facilities can become important because the cost of maintaining a research facility are relatively fixed regardless of whether the facility is fully staffed. Doing research at a facility that is not being used to capacity will be more costly than research done at a well-used facility because the research projects underway at the underused facility will have to absorb the fixed costs."

This statement suggests to me that the joint use of federally supported facilities can be a two-way street in that the costs of the shared facility can be reduced while providing obvious benefits to the couser.

In light of this relationship, I am pleased to report that such joint use occurs in New Mexico and has proven to be tremendously beneficial. Such joint use permits access to equipment and expertise which would otherwise be unavailable. I see that Dr. Ellis Huddleston came into the room. He has supplied me with some of these examples. Our Department has responsibility for controlling pests, insects out in the State. I have worked closely with Dr. Huddleston and asked him to get me out of the business of spraying, if you would, because it is expensive.

But in his research, for example: One, the equipment and expertise of personnel at the atmospheric sciences laboratory at the White Sands Missile Range facilities have been utilized in the area of pesticide application to study specifically the relationship of various factors on droplet size and efficacy; two, the wing design development at the National Aeronautic and Space Administration [NASA] is being applied to aircraft of aerial pesticide applicators; three, facilities at Sandia Laboratories, located in Albuquerque, N. Mex., have been used in the sampling of pesticides and other contaminants in air; and four, the Jornada Range Experimental Test site has been used by New Mexico State University and the Animal and Plant Health Inspection Service [APHIS] to test the aerial application of various pesticides. These examples demonstrate the importance of technology transferring involving government, universities, and the private enterprise sector in terms of impetus, such transfers can receive from increased cooperation

Despite the fruitful cooperation which has been experienced, as I illustrated by these examples, such cooperation as joint use has been limited and could be certainly expanded. There are, in addi-

tion, still barriers to realizing the full potential of joint use, barriers of policy and practice which can be quite inhibiting and debilitating.

Accordingly, I would recommend to the subcommittee the promulgation of a national policy specifically mandating a more intensive utilization of federally supported facilities through joint use. In this vein, it would perhaps be appropriate to suggest the creation of a representative, interdisciplinary national advisory committee to recommend to the appropriate Federal agencies a means of more effectively utilizing existing facilities.

The overriding issue which encompasses the matter of actual joint use of facilities is the broader question of communication. It is imperative that more sharing of information occur. A candid and responsive dialog needs to be established between federally supported facilities and potential joint users so that an informed determination can be made as to the type of research actually being conducted. This will then permit an enlightened assessment of how these activities might be applied to agricultural research.

In order to effect this communication, I am pleased to offer my assistance at the State and regional level. And at the national level, I can assure you of the full cooperation and assistance of the commissioners, directors, and staff of the National Association of State Departments of Agriculture.

In summary, in my opinion, there are abundant and compelling reasons to make a conscious and concerted effort to encourage joint use of federally supported facilities in the area of agricultural research. There are tangible benefits to be derived in both the short and long term. Principal among these benefits would be an increase in the efficient and economic use of existing research facilities and expertise.

Mr. Chairman, that concludes my formal presentation. Again, I thank you for the opportunity to express my views.

Mr. SKEEN. Thank you very much, Dr. Stephens, and we certainly do appreciate the testimony and points that you presented.

I think, unless anybody is in a bind for some physiological reason, we will just continue with the questioning. And I would like for my colleague, who has been kind enough to agree to let me chair this thing so that I can sit here and hold the hammer—why don't you begin the questions.

[The prepared statement of Dr. Stephens follows:]

STATE OF NEW MEXICO

Department of Agriculture

GOVERNOR'S CABINET

TONEY ANAYA
Governor

Box 3189, NMSU Campus
Las Cruces, New Mexico 88003
Phone: (505) 646-3007

DR. WILLIAM P. STEPHENS
Secretary

STATEMENT OF
DR. WILLIAM P. STEPHENS, SECRETARY OF AGRICULTURE
NEW MEXICO DEPARTMENT OF AGRICULTURE
BEFORE THE INVESTIGATIONS AND OVERSIGHT SUBCOMMITTEE
OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY,
UNITED STATES HOUSE OF REPRESENTATIVES

HEARINGS ON MAY 13, 1983 IN LAS CRUCES, NEW MEXICO
RELATIVE TO THE JOINT USE OF
FEDERALLY SUPPORTED RESEARCH FACILITIES.

MR. CHAIRMAN, MEMBERS OF THE SUBCOMMITTEE. MY NAME IS WILLIAM P. STEPHENS. I AM SECRETARY OF AGRICULTURE FOR THE STATE OF NEW MEXICO, AND FORMER ASSISTANT DIRECTOR OF THE NEW MEXICO AGRICULTURAL EXPERIMENT STATION.

IT IS A PLEASURE FOR ME TO APPEAR BEFORE YOU TODAY TO OFFER MY THOUGHTS ON THE JOINT USE OF FEDERALLY SUPPORTED RESEARCH FACILITIES. I HOPE I CAN MAKE A CONTRIBUTION TO THE DISCUSSION AND DELIBERATION SURROUNDING THIS CRITICALLY IMPORTANT TOPIC.

SINCE OTHER SPEAKERS ON THE AGENDA WILL BE FOCUSING ON THE MORE TECHNICAL AND SPECIFIC ASPECTS OF SHARED RESEARCH EFFORTS, I WILL CONFINE MY REMARKS TO A MORE GENERAL DISCUSSION OF THIS PROPOSITION.

THERE IS NO QUESTION IN MY MIND AS TO THE DESIRABILITY OF INTENSIFYING AND REFINING COOPERATIVE RESEARCH RELATIONSHIPS INVOLVING FEDERALLY SUPPORTED FACILITIES. THE ENHANCEMENT OF THE UTILIZATION OF EXISTING FACILITIES HAS BOTH SCIENTIFIC RESEARCH AND FINANCIAL OVERTONES.

IN ORDER TO UNDERSTAND THE SIGNIFICANCE AND RAMIFICATIONS OF THIS ISSUE, IT IS IMPERATIVE TO FULLY APPRECIATE THE CENTRAL ROLE RESEARCH PLAYS IN THE CULTURAL VITALITY AND PRODUCTIVE SUCCESS OF AMERICAN AGRICULTURE. THE EXTRAORDINARY PRODUCTIVITY AND EFFICIENCY OF THE AGRICULTURAL INDUSTRY MUST BE ATTRIBUTED IN LARGE PART TO THE FRUITS OF CONCERTED RESEARCH.

YET THESE RESEARCH SUCCESSES ARE NOT AUTOMATIC AND CANNOT BE TAKEN FOR GRANTED. THEY HAVE OCCURRED AS A RESULT OF DEDICATION, HARD WORK, TIME, A LITTLE LUCK, CONSIDERABLE FUNDING AND THE AVAILABILITY OF ADEQUATE FACILITIES. I WOULD ALSO ADD THAT RESEARCH IS NOT THE EXCLUSIVE DOMAIN OF ANY SINGLE SECTOR, BE IT UNIVERSITIES, GOVERNMENT, OR INDUSTRY. RESEARCH BOTH TRANSCENDS AND ENCOMPASSES THESE INDIVIDUAL AREAS.

IN LIGHT OF THIS INHERENT INTERDEPENDENCE, THERE ARE SIGNIFICANT BENEFITS TO BE DERIVED FROM CLOSE COOPERATION, INCLUDING THE JOINT USE OF EXISTING FACILITIES. THESE BENEFITS WOULD INCLUDE: A MORE INTEGRATED, HEIGHTENED, AND EFFECTIVE USE OF LIMITED RESOURCES, BOTH HUMAN AND PHYSICAL PLANT CAPACITY; A REALIZATION OF

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CONSIDERABLE COST SAVINGS AND INCREASED INTERACTION WITHIN THE RESEARCH COMMUNITIES; AND CREATION AND MAINTENANCE OF AN ATMOSPHERE CONDUCIVE TO MORE INTENSIVE AND INNOVATIVE RESEARCH. TAKEN TOGETHER, THESE CONDITIONS ALSO ADD TO AN ATMOSPHERE WHICH IS ATTRACTIVE TO INDUSTRY, FOR IT SIGNIFIES FERTILE GROUND FOR SUSTAINABLE RESEARCH.

YET NO MATTER HOW LOFTY THE AIMS OR HOW LIMITED THE INQUIRY OF RESEARCH, THE ULTIMATE SUCCESS OR FAILURE OF A RESEARCH PROJECT IS OFTEN AS DEPENDENT ON THE LEVEL OF FUNDING AND SUPPORT AS IT IS ON SCIENTIFIC CONSIDERATIONS. ACCORDINGLY, IT IS INCUMBENT UPON ALL OF US TO GARNER THE NECESSARY RESOURCES TO ENSURE AN EFFECTIVE NATIONAL POLICY TOWARD RESEARCH. IN THIS REGARD, WE SHOULD CAREFULLY CONSIDER THE STATEMENT APPEARING IN THE FOURTEENTH ANNUAL REPORT OF THE NATIONAL BOARD OF SCIENCE, NATIONAL SCIENCE FOUNDATION WHICH STATES: "THIS REPORT STARTS FROM A CONVICTION THAT THE HEALTH, WELFARE, AND DEFENSE OF OUR SOCIETY ARE DIRECTLY, AND NOT AT ALL MYSTERIOUSLY, RELATED TO THE STRENGTH AND VIGOR OF OUR SCIENCE AND RESEARCH CAPABILITIES".

ONE MEANS OF ENSURING THIS "STRENGTH AND VIGOR" IS TO INCREASE UTILIZATION OF EXISTING FEDERALLY SUPPORTED FACILITIES THROUGH JOINT USE. THIS TYPE OF SHARING IS EVEN MORE REASONABLE AND FAVORABLE WHEN IT IS REALIZED THAT IF THIS COOPERATION WERE NOT TO OCCUR, MANY FEDERALLY SUPPORTED FACILITIES WOULD

EXPERIENCE EVEN GREATER UNDERUTILIZATION OF AVAILABLE CAPACITY. AND THIS IS SIMPLY A WASTE OF RESOURCES THE FEDERAL GOVERNMENT AND WE, AS A NATION, CANNOT AFFORD.

THE MAGNITUDE OF THIS PROBLEM OF UNDERUTILIZATION IS ILLUSTRATED, IN PART, BY THE JANUARY 14, 1983 GENERAL ACCOUNTING OFFICE REPORT ENTITLED "FEDERAL AGRICULTURAL RESEARCH FACILITIES ARE UNDER USED".

AS THE REPORT STATES, AND I QUOTE: "THE USE RATE OF FACILITIES CAN BECOME IMPORTANT BECAUSE THE COST OF MAINTAINING A RESEARCH FACILITY ARE RELATIVELY FIXED REGARDLESS OF WHETHER THE FACILITY IS FULLY STAFFED. DOING RESEARCH AT A FACILITY THAT IS NOT BEING USED TO CAPACITY WILL BE MORE COSTLY THAN RESEARCH DONE AT A WELL-USED FACILITY BECAUSE THE RESEARCH PROJECTS UNDERWAY AT THE UNDER USED FACILITY WILL HAVE TO ABSORB THE FIXED COSTS".

THIS STATEMENT SUGGESTS TO ME THAT THE JOINT USE OF FEDERALLY SUPPORTED FACILITIES CAN BE A TWO-WAY STREET IN THAT THE COSTS OF THE SHARED FACILITY CAN BE REDUCED WHILE PROVIDING OBVIOUS BENEFITS TO THE CO-USER.

IN LIGHT OF THIS RELATIONSHIP, I AM PLEASED TO REPORT THAT SUCH JOINT USE OCCURS IN NEW MEXICO AND HAS PROVEN TO BE TREMENDOUSLY BENEFICIAL. SUCH JOINT USE PERMITS ACCESS TO EQUIPMENT AND EXPERTISE WHICH WOULD OTHERWISE BE UNAVAILABLE.

LET ME BRIEFLY IDENTIFY THE TYPE OF COOPERATION INVOLVED. THESE EXAMPLES ARE BASED ON INFORMATION PROVIDED BY DR. ELLIS HUDDLESTON, ACADEMIC DEPARTMENT HEAD, ENTOMOLOGY AND PLANT PATHOLOGY, COLLEGE OF AGRICULTURE AND HOME ECONOMICS, NEW MEXICO STATE UNIVERSITY.

1. THE EQUIPMENT AND EXPERTISE OF PERSONNEL AT THE ATMOSPHERIC SCIENCES LABORATORY AT THE WHITE SANDS MISSILE RANGE FACILITIES HAVE BEEN UTILIZED IN THE AREA OF PESTICIDE APPLICATION TO STUDY SPECIFICALLY THE RELATIONSHIP OF VARIOUS FACTORS ON DROPLET SIZE AND EFFICACY.

2. THE WING DESIGN DEVELOPMENT AT THE NATIONAL AERONAUTIC AND SPACE ADMINISTRATION (NASA) IS BEING APPLIED TO AIR CRAFT OF AERIAL PESTICIDE APPLICATORS.

3. FACILITIES AT SANDIA LABORATORIES LOCATED IN ALBUQUERQUE, NEW MEXICO HAVE BEEN USED IN THE SAMPLING OF PESTICIDES AND OTHER CONTAMINANTS IN AIR.

4. THE JORNADA RANGE EXPERIMENTAL TEST SITE HAS BEEN USED BY NEW MEXICO STATE UNIVERSITY AND THE ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS) TO TEST THE AERIAL APPLICATION OF VARIOUS PESTICIDES;

AND THE FINAL EXAMPLE INVOLVES:

5. THE NEED FOR NMSU TO WORK WITH THE BLM IN CALIBRATING AND DESIGNING BETTER WAYS TO CONTROL BRUSH, WHICH IS THE SINGLE MOST SERIOUS PROBLEM FACING OUR RANGE LANDS. THOUGH JUST BEGINNING AND NOT YET FULLY ESTABLISHED, THIS IS ANOTHER AREA IN WHICH WE HOPE TO ENHANCE PRODUCTIVITY, EFFICIENCY AND ECONOMY THROUGH JOINT USE AND COOPERATION.

IT SHOULD BE NOTED FROM THESE EXAMPLES THAT THE RESEARCH RESULTS ARE APPLICABLE TO THE PRIVATE SECTOR. THIS FACT TENDS TO COMPOUND AND INTENSIFY THE ORIGINAL SPIN-OFF EFFECT OF THE INITIAL COOPERATIVE MEASURES, FURTHER REAFFIRMING AND ACCENTUATING THEIR VALUE.

THESE EXAMPLES FURTHER DEMONSTRATE THE IMPORTANCE OF TECHNOLOGY TRANSFER INVOLVING GOVERNMENT, UNIVERSITIES AND THE PRIVATE ENTERPRISE SECTORS IN TERMS OF THE IMPETUS SUCH TRANSFERS CAN RECEIVE FROM INCREASED COOPERATION.

WHILE TIME DOES NOT PERMIT ME TO ADEQUATELY EXPAND ON THE VITALLY IMPORTANT TOPIC OF TECHNOLOGY TRANSFER, I AM SUBMITTING TO THE SUBCOMMITTEE FOR THE RECORD AS A PORTION OF MY WRITTEN TESTIMONY A PAPER ON THIS SUBJECT PREPARED FOR THE WESTERN GOVERNORS' CONFERENCE BY MR. FRANK LUNDBURG, WHO HAS SERVED AS A MEMBER OF THE GOVERNOR'S STAFF IN IDAHO AND AS SENIOR CONSULTANT WITH ELECTRO-WATT, A MULTINATIONAL ENGINEERING AND CONSULTING FIRM HEADQUARTERED IN ZURICH, SWITZERLAND.

DESPITE THE FRUITFUL COOPERATION WHICH HAS BEEN EXPERIENCED, AS ILLUSTRATED BY THESE EXAMPLES, SUCH COOPERATION AS JOINT USE HAS BEEN LIMITED AND COULD CERTAINLY BE EXPANDED. THERE ARE, IN ADDITION, STILL BARRIERS TO REALIZING THE FULL POTENTIAL OF JOINT USE; BARRIERS OF POLICY AND PRACTICE WHICH CAN BE QUITE INHIBITING AND DEBILITATING. THESE BARRIERS, SUCH AS ACCESS TO DATA AND EQUIPMENT, ARE NOT INSURMOUNTABLE OBSTACLES. THEY CAN AND MUST BE OVERCOME.

ACCORDINGLY, I WOULD RECOMMEND TO THE SUBCOMMITTEE THE PROMULGATION OF A NATIONAL POLICY SPECIFICALLY MANDATING A MORE INTENSIVE UTILIZATION OF FEDERALLY SUPPORTED FACILITIES THROUGH JOINT USE. IN THIS VEIN, IT WOULD PERHAPS BE APPROPRIATE TO SUGGEST THE CREATION OF A REPRESENTATIVE, INTERDISCIPLINARY NATIONAL ADVISORY COMMITTEE TO RECOMMEND TO THE APPROPRIATE FEDERAL AGENCIES MEANS OF MORE EFFECTIVELY UTILIZING EXISTING FACILITIES.

THE OVERRIDING ISSUE WHICH ENCOMPASSES THE MATER OF ACTUAL JOINT USE OF FACILITIES IS THE BROADER QUESTION OF COMMUNICATION. IT IS IMPERATIVE THAT MORE SHARING OF INFORMATION OCCUR. A CANDID AND RESPONSIVE DIALOGUE NEEDS TO BE ESTABLISHED BETWEEN FEDERALLY SUPPORTED FACILITIES AND POTENTIAL JOINT USERS SO THAT AN INFORMED DETERMINATION CAN BE MADE AS TO THE TYPE OF RESEARCH ACTUALLY BEING CONDUCTED. THIS WILL THEN PERMIT AN ENLIGHTENED ASSESSMENT OF HOW THESE ACTIVITIES MIGHT BE APPLIED TO AGRICULTURAL RESEARCH.

THROUGH AN IMPROVED SYSTEM OF COMMUNICATION AND EXCHANGE OF INFORMATION, THOSE ADMINISTERING THE FACILITIES WILL BETTER KNOW THE NEED OF THOSE IN THE AREA OF AGRICULTURAL RESEARCH, AND WE WILL BETTER KNOW WHAT THEY HAVE TO OFFER.

INORDER TO EFFECT THIS COMMUNICATION, I AM PLEASED TO OFFER MY ASSISTANCE AT THE STATE AND REGIONAL LEVEL. AND AT THE NATIONAL LEVEL, I CAN ASSURE YOU OF THE FULL COOPERATION AND ASSISTANCE OF THE COMMISSIONERS, DIRECTORS AND STAFF OF THE NATIONAL ASSOCIATION OF STATE DEPARTMENTS OF AGRICULTURE.

IN SUMMARY, IN MY OPINION THERE ARE ABUNDANT AND COMPELLING REASONS TO MAKE A CONSCIOUS AND CONCERTED EFFORT TO ENCOURAGE JOINT USE OF FEDERALLY SUPPORTED FACILITIES IN THE AREA OF AGRICULTURAL RESEARCH. THERE ARE TANGIBLE BENEFITS TO BE DERIVED IN BOTH THE SHORT AND LONG TERM. PRINCIPAL AMONG THESE BENEFITS

WOULD BE AN INCREASE IN THE EFFICIENT AND ECONOMIC USE OF EXISTING RESEARCH FACILITIES AND EXPERTISE. DURING THESE PERILOUS ECONOMIC TIMES, WE CAN ILL AFFORD TO WASTE PRECIOUS LIMITED RESOURCES.

I THEREFORE URGE THE MEMBERS OF THIS SUBCOMMITTEE, FOR THE BENEFIT OF A STRONG, VITAL, AND PRODUCTIVE AGRICULTURAL SECTOR, TO CAREFULLY CONSIDER THE TESTIMONY PRESENTED TODAY IN THEIR DELIBERATIONS ON THIS CRUCIAL ISSUE.

MR. CHAIRMAN, THIS CONCLUDES MY FORMAL PRESENTATION TODAY. I AGAIN WISH TO THANK YOU FOR THIS OPPORTUNITY TO EXPRESS MY VIEWS, AND I AM PREPARED TO RESPOND TO ANY QUESTIONS YOU MAY HAVE.

Mr. DURBIN. I might say it kind of typifies science and technology as we found there is very little room for partisanship. We have got some national concerns here, and I think a cooperative effort, bipartisan spirit is best for what we've got in the committee and possibly in the Nation.

I would like to ask Mr. Wugalter, as the last secretary of education of New Mexico, that you are, I'm sure, aware of the different functions that are performed at different levels in our educational spectrum. And the thing that I have always thought is that the university, particularly in my home State of Illinois, where I am more familiar, the university more or less directs its effort to the basic research.

I visited 1 month ago at the University of Illinois, and we are very proud of our science facilities there. We graduate more Japanese graduates from the University of Illinois than any university in the Nation, which I think says something for what we have to offer.

As I went through the lab and saw the National Science Foundation, I would ask the students and the faculty, "What is the practical use of this research which you are doing?" And their basic answer was, "We don't know yet, but we're doing the research." We're moving along in this continuum of expanded education, expanded knowledge, and we have found that in the long run, what we do ultimately has a commercial application. That seems to me to be a rather traditional role performed by a university.

From your testimony this morning, though, you talked about industry and universities working for specific objectives—if I could put words in your words. I could assume that when Rockwell International enters into a university atmosphere, you always have in mind how to merge these two, if not competing interests, at least interests that have to be complimentary, for them to be successful?

Mr. WUGALTER. Merged first with the interest of the individuals because we have to have the talent available. The talent and the hardware have to be available. Generally we have a patent of a particular innovation—super plastic aluminum alloy process. How do we expand it now? What good is it in the laboratory? A fire retardant intermiscient coating of molified. It's in that laboratory,

but it shouldn't sit there. It has to have room somewhere, it has to be sprayed somewhere. It has to create something to be of value. We just don't want to win awards. We go to Chicago to pick them up at the University of Chicago Museum of Science and Industry.

We blend with the people we work with at the universities to find out if there are sufficient graduates available and a contrast is generally consummated to do a particular type of work. The objectives are spelled out. There is leeway for discretion innovation so that in the process of developing a particular line, something else takes place in the laboratory. We should not deviate from the exploratory end. So you go into the theoretical, although we may have started with applied.

Mr. DURBIN. So you leave it open-ended?

Mr. WUGALTER. We leave it open-ended unless it is a direct contract with, say, the office where we want certain films done on particlar items, and that is what we stick with. But generally the discretion is there. But your question is how do you do that? I think that's your question: How do you do that?

We have to work with the people in the various departments on a 1-to-1. You have to vist with them. For example, the Carnegie Institute working on initial intelligence, looking into a tremendous number of devices—crawlers, crabs, all sorts of interesting operations. When we work with them, work with their people at the institute, we may be working on a satellite that they don't even know exists, and there is a sensor that we are developing that could be of value to them in their work. The question then is between the scientist and the principal investigators who are working on this problem. How do you then transfer some of this technology and do it in such a way that it is of benefit to improve their research capability, even though we may never see an end product for our manufacturing.

Do you follow what I'm saying? It's not going to be our metal, it's not going to be our airplane. It's part of what we consider improving the national program of research.

Mr. DURBIN. It appears, from what your testimony is this morning, that your company is very sensitive to maintaining some rather traditional roles in terms of universities, branch colleges, community colleges. Have you seen abuses, though? Have you seen what an abuse does to the detriment of the university function? We cannot determine sometimes whether or not we need more insulation mechanisms to protect that basic role of the university when higher education is getting bitten from head to toes as to money. Year in and year out they are looking for opportunities to expand their resources and facility, and we want them still to maintain that basic theoretical and basic research function.

Mr. WUGALTER. I have not seen abuses. I am trying to imagine the type of abuses you may be talking about. And that is, will the university do everything possible to change its configuration to please an industry? That's what I think you are talking about. No, I haven't seen that. I think universities are much stronger than that because the industries that I work with are not interested. If we wanted a university, we would buy it.

A university has a mission. A university has a mission, and that is to permit the talent that exists to roam freely and go from theo-

retical to applied. You can't superimpose a hardcore and say: "You are going to be my university and only so."

Mr. DURBIN. I think you make a good point, and I think also that we have seen a change in the university-industry relationship in the 1950's that might have been closer with more direct involvement of grants being given to universities, and then the Government moved in, played a larger role, and now we're suggesting that perhaps the two can work with the university community very closely.

I think many universities are going through a period of introspection of what their proper function is.

Mr. WUGALTER. One of the items you mentioned that concerns me and you hit is when over 40 or 50 percent of the graduating class in Ph. D.'s are foreign nationals, very concerned.

Mr. DURBIN. I can tell you what the University of Illinois retorts, and that is, their bachelor graduates are quickly brought into America and trained for roles, and that the students from the foreign countries are there to pick up advanced degrees.

Mr. WUGALTER. Let me suggest you do a little close work on that. Why don't you talk to the students themselves?

Mr. DURBIN. What do you think is the reason?

Mr. WUGALTER. Remember, most of the foreign students are called—they're the best and they are serious, 24 hours a day, 7 days a week. Our students often can't give that. There is a different commitment. They come from different lifestyles. Therefore, a department chairman loves a foreign student. He will be there in the lab 36 hours a day.

Mr. DURBIN. I would like to ask Dr. Williams a related question. I think one of the real frustrations, too, in review of the theoretic university resources and Federal research resources in this country, is the fact that we seem to miss that link between that idea and the technology that applies to a product. The ceramic engine is one that has been kicked around quite a bit in Washington, and I think there was originally some research developed in Great Britain, but ultimately it was abandoned 15 years ago. And now the Japanese are developing ceramic engines that we are going to have to want to compete with. The feeling is we have some of the most advanced ideas in the world. What steps are we missing that we need?

Dr. STEPHENS. I think the key is that there are people in research laboratories and in universities who are very busy doing that research, and they have good ideas. Not all of them ever think about its practical application. Their researchers, their primary purpose in life is to expand the frontiers of knowledge because that's a knowledge base that creates an atmosphere in which innovatie ideas can be made practical.

There has been a tendency, I think, on the part of the national laboratories, for example, to go forward and develop these ideas and even think of the practical application, but not to get tied in with the practical people in industry, as Harry was saying here a moment ago. The people who have a feel for what is going on in the marketplace and what will sell and what is the next innovation that could really make a difference. And there have been reasons for that.

You know, if you have an idea, for example, in a laboratory, there is not much incentive to take it elsewhere. In fact, there are barriers. You can't get exclusive patent rights on it, for example, so you don't have the incentive to go out and take the risk in spending your own money, or the capitalists wouldn't invest in it. A venture capitalist won't invest in it, so there is no incentive for him to go out.

On the other side, if you are in the industry and the government has developed an idea to the point where it is really to be used in the commercial market and everybody has access to it, equal access, and has absolutely no margin, if you will, no competitive edge because they don't have an exclusive license, for example, who is going to invest once again to find out if that market is really there? And I think that the key here is that somehow we have got to cut down some of these barriers that allow the free flow of intellectual property from the research laboratory into industry so that the individual, for example, who has the ideas that they like to make it practical, as citizens they want to see the country prosper, too, have some way maybe to go out in the city and interact with people at the grassroots level who are trying to produce products to make a profit and pay taxes and that sort of thing.

But I really think that that barrier has got to be changed. There has been legislation. There is no liberal interpretation of the rules on how you handle the intellectual property that is developed with the taxpayers' dollar, and we are beginning, now, I think, to move in the direction of doing this. But, you know, laboratories have always been relatively open except for classified reasons, and it's interesting to see who comes. The foreigners love to come and see what we are doing in technology and in the past, particularly 10 years ago, we never saw anyone coming from industry saying, "Hey, what good ideas you have." Well, that is changing. That is really changing, and I think it's because the national conscience, if you will, has begun to realize: Hey, we have a resource and we haven't been using it. We have to work together. It's a bigger country, more diverse than, say, a place like Japan.

You mention the ceramic engine program. They seem to be able to pull all their resources together—industry, university, laboratory—and they establish a program that covers basic research through the component development; whereas in this country, you will have some industries that will object to the Federal Government doing work on cermaic engines because they feel they will never be used. It is difficult for industries to work together on such a development where maybe one or two companies will benefit from it. So those are the main obstacles that I see.

As far as patent waivers, we have had success now with the facility at Brookhaven, the national synchrotron light source. We have been able to obtain a blanket waiver for anyone regardless of whether they are an industry or university. If they want to use the facility and the research will bring out in the open literature available to everyone, then we can waive the patent rights.

Mr. DURBIN. I might note that the committee is planning hearings at the end of June which will address this specific consideration—the antitrust laws and our Government policies that may

inhibit research and progress—we are going to spend one day taking a look at Japan. I have noticed, Congressman Skeen, that if you don't mention Japan at an official hearing, then it is not an official hearing.

But I think it indicates the fact that we realize we have got some ground to cover, and I appreciate your comment.

Secretary Stephens, when I fly home, I am going to fly over more flooding and water. I have spent the last 5 months trying to cope with it in my congressional district where we have these difficulties. I have been particularly interested in agriculture.

It would seem that over the years there has been a very good partnership between Government and agriculture in this country going back to President Lincoln signing the land grant bills and establishing agriculture. For over 120 years we have had this close relationship. Have we gotten lazy where research is so good that our concern is how to cut down production, that we are not really putting the input into agricultural research that I think we need, and I hope you think we need for the future?

Dr. STEPHENS. I think one of the things that concerns me is perhaps the general public doesn't understand that we will—even the engineers say, "Well, why don't we get these appropriations to do research and engineering like Koert Lessman is doing over in agriculture?" Well, to me there are several reasons for this. And if we could get across to the general public that in the final analysis it is the public that pockets this, because due to the maker of competition in farming or ranching, it goes right through and it goes on down to the consumer in final analysis. And I think sometimes, too with our capacity as it is, we have to find export markets for a third or more of our total production. Why should we be spending money to become more efficient in agriculture and research? And sometimes that is difficult to explain but for the general public to understand.

So I think we have become complacent to some extent in getting this message across, but I still feel we cannot back away from the effort that it takes here to keep agriculture out front.

Mr. DURBIN. I think the food needs not only in our Nation, but in the world to come, will be so sufficient that we can't afford to slow down.

But I thank you all for your testimony. I appreciate it very much.

Mr. SKEEN. I want to thank you, and I don't want to prolong the questioning. I would like to make this comment. He said something that you have to mention Japan if you talk about technology. And the Japanese have, I think, distinguished themselves in the fact that because of their homogeneous society and the way they do things, that they are able to take abstract ideas that we handle in research and development, and go ahead and work toward putting a market together. And one of the greatest examples appeared in the Washington Post, which is our least readable publication in the Washington area. It had a very fine group of articles on technological transfer citing one example of Bell Laboratory's development of fiber optics but which did not carry it to the market situation. They gave it to the Japanese, who gave us fiber optics as we have them today.

And just one comment in that regard. We have a lot of Japanese who visit the Congress of the United States and they are all in the hearings, very interested in what is going on in the science and technological field, and so forth. In talking to one of them, I said, "What is the great interest that you have?" "Well," he said, "you folks have been our teacher. Now we are over here studying our obsolescence," which is a strange explanation. And he was very serious about it. He wasn't trying to be arrogant, but he said, "We are studying our obsolescence" because what we are not doing is beginning to do the things that I think that you folks have talked about today—collaborating between private sectors, Federal laboratories, and universities, which is a tremendous combination. And I want to compliment you all on the testimony that you have given today, and I am not going to belabor it any more.

Any questions the staff would like to ask? Anyone from the public?

Mr. GOODRICH. I am Jim L. Goodrich, Goodrich, Barton, & Associates, advanced planning feasibility, coordination consultants. And we have established an activity in this area called advanced resources development research activity, which is predicated somewhat on the concept of an innovation center, as described in Public Law 96-480, paragraph 6, section 6. We have encouarged for some time—for about 10 years—this concept of synergetic performance between and among technical people in various disciplines and fields and between industry, Government laboratories, and academia.

We have actually, without calling it that, accomplished one project locally that uses the organization and principles that we have espoused, and that was done through the physical science laboratory. It's called the Clinton B. Anderson Physical Science Laboratory of the New Mexico State University. This project was for the purpose of determining the site, the proper site and configuration to accommodate an experimental range on White Sands Missile Range using technologies which are still undeveloped to the extent that it is desired to develop them.

This entity that we have espoused with the achronic ARTRA, standing for the words I mentioned, applied resources development research activity. One of the activities within that activity would be using teams of experts drawn on an ad hoc basis for an individual project, which is the problem to be worked on, and that those teams would be comprised of people who are basically in the master's Ph. D. level at universities or in midtechnical management in industry. And these teams would work on the various aspects of problems on-arising either in industry or academia or with Government laboratories or Government other than laboratory.

The idea would be to enhance the capability virtuosity of the members of these ad hoc teams and provide an acceleration of know-how and can-do for new industries or existing industries and provide the obtaining of so-called industrial persons for the master's and Ph. D. still on the campus on a work-study basis that otherwise they can't get. I don't want to go into any more detail on this. I can put more detail in the record.

Mr. SKEEN. I appreciate that very much, and I appreciate the statement. And if you do have something you would like to have

introduced in the record, we would appreciate your submitting it, and we will see that it is inserted. Thank you so much for your statement.

I think now that we are ready for the second panel. We want to thank you all once again, all of you that have participated in the first panel.

We have now the second panel—Dr. William Gahr, Jerry Calvani, Ed Hughs, and Dr. Edgar Kendrick. Why don't you all come up? We will enter your statement, if you wish, in the record, but we would appreciate it if you could summarize it. We will try to keep this moving as quickly as we can because we certainly want to get all the testimony that we can.

We will start off with Dr. Kendrick. Thank you very much for being here, Doctor. It has been a pleasure working with you, and I appreciate your coming to New Mexico to give your testimony.

Dr. KENDRICK. Thank you, Mr. Chairman. Since I was administratively in this area from 1972 to 1976, it is always a pleasure to come back to Las Cruces.

Mr. SKEEN. We're glad to have you back. We never lose a neighbor.

STATEMENTS OF DR. EDGAR L. KENDRICK, U.S. DEPARTMENT OF AGRICULTURE, ACTING DEPUTY ASSISTANT SECRETARY FOR SCIENCE AND EDUCATION, WASHINGTON, D.C.; DR. WILLIAM E. GAHR, ASSOCIATE DIRECTOR, RESOURCES, COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION, GENERAL ACCOUNTING OFFICE [GAO], WASHINGTON, D.C., ACCOMPANIED BY GERALD KILLIAN, GROUP DIRECTOR; JERRY CALVANI, CHAIRMAN, COTTON PRODUCERS OF NEW MEXICO, NEW MEXICO REPRESENTATIVE ON THE NATIONAL COTTON COUNCIL PRODUCTION STEERING COMMITTEE, CARLSBAD, N. MEX., ACCOMPANIED BY J. RITCHIE SMITH, DIRECTOR OF TECHNICAL SERVICES, NATIONAL COTTON COUNCIL; AND ED HUGHS, RESEARCH LEADER, SOUTHWEST COTTON GINNING RESEARCH LABORATORY, MESILLA PARK, N. MEX.

Dr. KENDRICK. Mr. Chairman and Congressman Durbin, I am Edgar L. Kendrick, Acting Deputy Assistant Secretary of Agriculture, testifying on behalf of the Office of the Assistant Secretary of Agriculture for Science and Education. I am pleased to be able to join you today to explore mechanisms on how USDA can more effectively work with the cotton industry and New Mexico State University to utilize and support federally owned and operated agricultural research facilities.

I understand that one of the factors that precipitated this hearing was the Department's consideration earlier this year of a proposal to consolidate the USDA Agricultural Research Service Southwest Cotton Ginning Research Laboratory with the Southern Plains Ginning Research Laboratory at Lubbock, Tex. This proposed consolidation was part of an overall package of program redirections with the objective of increasing the efficiency of our management and program operations in the Agricultural Research Service.

During our deliberations, it became clear that further review of all USDA cotton ginning research and alternative support mechanisms was needed. The USDA decision not to proceed at this time with the consolidation of the ginning laboratories assures the continued operation of the Las Cruces facility through fiscal years 1983 and 1984 and perhaps longer.

This hearing provides an important forum for initiating the review process that will take place during this period. As a point of beginning, it would be instructive to the committee and the group assembled at this hearing today to briefly review the issues that led to the earlier proposal to consolidate the ginning research laboratories.

USDA presently operates three ginning research laboratories, including one at Stoneville, Miss., and one at Lubbock, Tex., in addition to the Las Cruces facility. None of these laboratories is being fully utilized. The General Accounting Office has been critical of ARS for failing to consolidate underutilized facilities.

In a preliminary examination of the alternatives for the cotton ginning laboratory program and resources, ARS scientists and managers identified during the past year several options for more effectively and efficiently operating the ginning research laboratories.

One option was increased operating funding for all laboratories plus upgrading of building and equipment, including the Las Cruces facility. However, given the financial constraints of ARS and the Department, this option was not considered feasible.

A second major option was consolidation in order to bring together equipment, instrumentation, and a diverse group of biological and engineering scientists to conduct research on the development of new principles for ginning of cotton and to develop new concepts of systems-oriented research on the harvesting, ginning, and processing of cotton. We expected to be able to operate one central laboratory more efficiently than two or three separate ones. This was the option originally selected until we more recently decided to halt indefinitely the consolidation of the ginning laboratories.

This review of the resource constraints and other factors that led to the earlier proposal for laboratory consolidation provides but one example of many similar situations that occur in our agricultural research laboratories throughout the country. We need to find new approaches for all beneficiaries of these research programs to participate in them and increase their effectiveness.

The ginning laboratory of Las Cruces already has a broad base of cooperation with the cotton industry and universities in the Southwest. For example, laboratory personnel are working with the cotton breeders at the New Mexico Agricultural Experiment Station in the evaluation of the ginning and processing characteristics of new upland cotton varieties with unique fiber characteristics. Likewise, the ginning characteristics of the extra-long staple Pima cottons grown in Arizona, New Mexico, and the El Paso area are evaluated with roller ginning equipment in the Las Cruces Laboratory. The laboratory has also assisted the California Cotton Ginners Association in assessing dust levels in gins to meet potential OSHA standards. For more background on the program of the Las Cruces Laboratory, I am providing for the record a complete copy

of the Southwestern Cotton Ginning Research Laboratory Mission statement.

I would like to challenge the cotton industry and others here today to consider new ways of supporting the cooperative research of the laboratory which is of great mutual benefit to all of us.

Many of the current projects at the Las Cruces Cotton Ginning Laboratory are oriented toward refining existing ginning technology and solving the most immediate needs of the cotton industry. While USDA is pleased to have a responsive program of this type, we also have a major obligation to direct resources to the development of new concepts and other innovations in cotton ginning. Fundamental studies to meet the needs of the industry in the next century are appropriate to the Federal role and consistent with the ARS long-range program plan. In order for ARS to move into these important new areas of ginning research, the support of the industry and university are needed to help address the local and most immediate ginning problems of the cotton industry.

We look forward to working with the industry and the universities to explore possibilities of pooling our resources and strengthening our collaborative relationships. This could provide the means for more effectively utilizing this and similar facilities for the mutual benefit of all groups.

Mr. Chairman, this concludes my prepared statement. I will be pleased to answer any questions you may have.

[The prepared statement of Dr. Kendrick follows:]

STATEMENT OF

DR. EDGAR L. KENDRICK

ACTING DEPUTY ASSISTANT SECRETARY

FOR

SCIENCE AND EDUCATION

U. S. DEPARTMENT OF AGRICULTURE

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U. S. HOUSE OF REPRESENTATIVES

Las Cruces, New Mexico

May 13, 1983

24-902 O—83——5

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Mr. Chairman this concludes my prepared statement, I will be pleased to answer any questions you may have.

MISSION STATEMENT

SOUTHWESTERN COTTON GINNING RESEARCH LABORATORY

The mission of this research unit is to develop improved methods for ginning cotton in the irrigated West. The mission falls within the technological objective of developing improved methods for ginning and cleaning agricultural fibers and preparing them for conversion into yarns, webs, and fabrics. The mission is performed under three CRIS Work Units: 5513-20550-002, Cotton quality measurement and gin plant control and automation; 5513-20550-003, Conditioning, cleaning, and ginning cottons in the western area; and 5513-20550-004, Cotton gin design to minimize dust, noise, and energy use in western area ginneries. Ginning is a process that cotton goes through after harvest but prior to marketing the resultant fiber and seed. There is acute need of ginning research in energy, environmental problems, better cleaning of cotton, particularly, removal of fine dust, and automation with product quality control. Ginning is one step in the total cotton system, and it reacts with earlier steps such as harvesting and later steps as mill processing.

Dr. KENDRICK. I have with me Ed Hughs, who is research leader of the Las Cruces Cotton Ginning Laboratory and will help me out on any technical questions you may have later.

Mr. SKEEN. Thank you very much, Doctor. We appreciate your statement, and we would like to hear Mr. Hughs. When we get to the question period, I am sure that you will be of great help to us. We plan to have some questions.

The next testimony will come from Dr. William Gahr, Associate Director of Resources, Community, and Economic Development Division.

Dr. GAHR. Thank you, Mr. Chairman. I would like to introduce my associate, Mr. Killian, who is accompanying us today. He was more involved in what we did on ARS laboratories. This testimony that we have prepared for you today is based on a report that we issued on January 14, 1983, entitled "Federal Agricultural Research Facilities Are Underused." This work did not specifically address cotton or cotton ginning problems, but we believe that the issues that we discussed in that report are relevant to the focus of this hearing.

In our report we concluded that many of ARS' 148 domestic research locations were not staffed to their designed capacity—a condition which makes individual research projects more expensive.

According to the most current national figures available at the time of our review, ARS had research space for about 3,275 scientists. At that time ARS had 2,403 of its own scientists using the space, or about 73 percent of the rated capacity. In addition to that, there were also 317 non-ARS scientists, or about 10 percent of the rated capacity, who occupied space. The percentage of use at individual facilities varied from over 100 percent of designed capacity to as low as 17 percent of capacity. The overall underuse has resulted primarily from a declining personnel ceiling as well as construction of new facilities.

Notwithstanding the underuse of existing laboratories, new laboratories are still being planned. These additional facilities could further reduce the overall rate of use because ARS' personnel ceiling is not expected to rise in the foreseeable future.

To fully use its existing research facilities, ARS would require a substantial increase in its annual appropriations and higher personnel ceilings—something that is not likely to happen, considering today's projected Federal budget cuts and growing deficits.

ARS has closed some facilities and transferred staff to other locations to improve facility use. However, ARS told us that this approach had not been very successful because those affected by the closings pressured ARS to keep the facilities open. As a result, some facilities were still operating that would have been discontinued with the resources redirected to higher priority research.

ARS has tried other ways to improve facility use. It has leased or otherwise provided research space to other Federal or State agencies. Space at some locations has been more fully utilized because of the non-ARS scientists working there. ARS stated that this sharing of facilities improves communications among the scientists and enables the sharing agencies to carry out their roles and missions more effectively. ARS also has improved facility use with support personnel, and at times scientists, hired under cooperative agree-

ments with State agricultural experiment stations or other educational institutions.

With continued ARS hiring and funding constraints, the problem of underused Federal laboratory space for agricultural research likely will continue. Bringing in State or other Federal agencies helps improve laboratory use, but these alternatives will not likely solve the problem. States are sometimes reluctant to use Federal research facilities either because they are not designed to meet State needs or because of differing geographic locations. Also, other Federal agencies are faced with funding and staff limitation problems similar to those ARS faces. In the existing environment of projected Federal budget cuts and growing deficits, closing research facilities and, where appropriate, consolidating their functions with others, may be the most viable alternative available for reducing underused capacity.

ARS does not have a comprehensive plan to reduce the number of ARS-owned research locations. Any plan to close laboratories will need to be well coordinated and justified to those parties having an impact on the decision process. In developing a plan, factors such as the following need to be considered in determining which facilities to close.

First, scientists need to interact with enough other scientists to promote idea exchange and problem solving. During the Department of Agriculture's appropriation hearings for fiscal year 1979, the Assistant Secretary for Conservation, Research, and Education stated that laboratories with fewer than 10 scientists were not a viable critical mass in which enough scientists can interact to solve research problems in a reasonable period of time. A 1980 House Appropriations Committee report recognized that some research locations with fewer than 10 scientists were within or near State or other Federal research facilities and, therefore, had a critical mass when their resources were combined.

A second factor to consider in developing a comprehensive plan is that fewer locations could make more efficient use of scientific and other equipment and specialized buildings. Also, the administrators of all four ARS regional research centers said that available, up-to-date scientific equipment was an advantage their scientists had over scientists at smaller locations, unless the smaller labs were at or very near a university. Larger facilities also are better able to justify employing technicians to operate specialized equipment. Some scientists at small locations use research time to develop these skills. An additional advantage of fewer research locations is that it should require fewer area offices and less administrative support and overhead.

On the other hand, small research locations do allow for site-specific research. There are scientific reasons for conducting research in certain locales and not others, including: First, capacity to grow more than one crop in a growing season; second, proximity to research problems; or third, ability to contain disease organisms. These reasons may be a factor which in some cases overrides the interaction and efficiency issues. In these cases, ARS could consider using cooperative agreements with state agricultural experiment stations, in conjunction with land-grant colleges and universities,

to accomplish appropriate site-specific research. ARS has used such agreements successfully in the past.

Another factor to consider in any plans to close research laboratories is that ARS would be required to move or layoff Federal employees and to pay associated costs. According to ARS Western Regional Office officials, moving one employee costs between $12,000 and $15,000. These costs would have to be offset by the potential sales value or alternative use of unneeded laboratories and any reduction in operating and maintenance costs. The costs would not include the cost to the employee of possibly moving to a higher cost-of-living area or having to pay a higher mortgage interest rate for a home. It is also difficult to place a price on the cost to morale of uprooting a scientist and family and redirecting the scientist's career.

Such a career change, according to ARS officials, may have long-range professionals and financial repercussions to a scientist. Because much ARS research is long term, a scientist may work for several years to achieve publishable results. Publications are one element that supervisors consider when deciding to promote a scientist. Therefore, a scientist who starts new research as a result of a move and experiences the expected delay before publishing the results may not be promoted as soon as if the move did not take place.

Another factor to consider is the large number of scientists reaching retirement age. A recent Senate report stated that the average age of ARS scientists was rapidly approaching 50 years. This could indicate that changes in research facilities and personnel may be more feasible in the near future.

Finally, the establishment of research priorities is an important factor in developing a comprehensive plan.

In our report, we recommended that the Secretary of Agriculture develop a plan to consolidate agricultural research activities at fewer locations, thereby allowing greater scientist interaction and more efficient use of equipment, facilities, and administrative resources. We added that the plan also needs to address research priorities, personal and career plans of ARS employees, the costs of relocating employees, and the potential sales values or other uses of unneeded laboratories. We also recommended that the Secretary submit the plan to the appropriate committees of the Congress for their review and comments.

The Department replied that ARS was developing a strategic plan to use as a basis for future research management. It added that the implementation and operational plans that support the strategic plan should be an excellent basis for the Secretary of Agriculture to assure consolidation of research and permit greater scientist interaction for more efficient use of equipment, facilities, and administrative resources.

That concludes my statement, Mr. Chairman.

[The prepared statement of Dr. Gahr follows:]

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

FOR RELEASE ON DELIVERY
EXPECTED AT 9:00 A.M. MST
FRIDAY, MAY 13, 1983

STATEMENT OF
WILLIAM E. GAHR, ASSOCIATE DIRECTOR
RESOURCES, COMMUNITY, AND ECONOMIC DEVELOPMENT DIVISION

BEFORE THE
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY

ON

USE OF FEDERALLY SUPPORTED RESEARCH FACILITIES

MR. CHAIRMAN AND MEMBERS OF THE SUBCOMMITTEE:

We are here today at the request of the Subcommittee to discuss the joint use of federally supported research facilities by industry and universities. You asked us to explore with you how a stronger industry/university relationship would increase, as an example, the viability of the Agricultural Research Service's (ARS) cotton gin laboratory at New Mexico State University.

This testimony is based on our report, "Federal Agricultural Research Facilities Are Underused," issued on January 14, 1983 (GAO/RCED-83-20). Although our work did not include the cotton gin laboratory, we believe that the issues addressed in our report are relevant to the focus of your hearing.

In our report we concluded that many of ARS' 148 domestic research locations were not staffed to their designed capacity--a condition which makes individual research projects more expensive.

According to the most current national figures available at the time of our review, ARS had research space for about 3,275 scientists. At that time ARS had 2,403 of its own scientists using the space, or about 73 percent of the rated capacity. There were also 317 non-ARS scientists, or about 10 percent of the rated capacity, also using the space. The percentage of use at individual facilities varied from over 100 percent of designed capacity to as low as 17 percent of capacity. The overall underuse has resulted primarily from a declining personnel ceiling as well as construction of new facilities.

Notwithstanding the underuse of existing laboratories, new laboratories are still being planned. These additional facilities could further reduce the overall rate of use because ARS' personnel ceiling is not expected to rise in the foreseeable future.

To fully use its existing research facilities, ARS would require a substantial increase in its annual appropriations and higher personnel ceilings--something that is not likely to happen considering today's projected Federal budget cuts and growing deficits.

ARS has closed some facilities and transferred staff to other locations to improve facility use. However, ARS told us that this approach had not been very successful because those affected by the closings pressured ARS to keep the facilities open. As a result, some facilities were still operating that would have been discontinued with the resources redirected to higher priority research.

ARS has tried other ways to improve facility use. It has leased or otherwise provided research space to other Federal or State agencies. Space at some locations has been more fully utilized because of the non-ARS scientists working there. ARS stated that this sharing of facilities improves communications among the scientists and enables the sharing agencies to carry out their roles and missions more effectively. ARS also has improved facility use with support personnel, and at times scientists, hired under cooperative agreements with State agricultural experiment stations or other educational institutions.

In addition, ARS has contracted out certain support services at large research facilities so as to retain scientists and technicians. These services included engineering, plant management, janitorial, and general services.

With continued ARS hiring and funding constraints, the problem of underused Federal laboratory space for agricultural research likely will continue. Bringing in State employees under cooperative agreements or leasing space to other Federal agencies helps improve laboratory use, but these alternatives will not likely solve the problem. States are sometimes reluctant to use Federal research facilities either because they are not designed to meet State needs or because of differing geographic locations. Also, other Federal agencies are faced with funding and staff limitation problems similar to those ARS faces. In the existing environment of projected Federal budget cuts and growing deficits, closing research facilities and, where appropriate, consolidating their functions with others,

may be the most viable alternative available for reducing underused capacity.

ARS does not have a comprehensive plan to reduce the number of ARS-owned research locations. Any plan to close laboratories will need to be well coordinated and justified to those parties having an impact on the decision process. In developing a plan, factors such as the following need to be considered in determining which facilities to close.

First, scientists need to interact with enough other scientists to promote idea exchange and problem solving. During the Department of Agriculture's appropriation hearings for fiscal year 1979, the Assistant Secretary for Conservation, Research, and Education stated that laboratories with fewer than 10 scientists were not a viable "critical mass" in which enough scientists can interact to solve research problems in a reasonable period of time. A 1980 House Appropriations Committee report recognized that some research locations with fewer than 10 scientists were within or near State or other Federal research facilities and therefore had a critical mass when their resources were combined.

A second factor to consider in developing a comprehensive plan is that fewer locations could make more efficient use of scientific and other equipment and specialized buildings. Also, the administrators of all four ARS regional research centers said that available, up-to-date scientific equipment was an advantage their scientists had over scientists at smaller

locations, unless the smaller labs were at or very near a university. Larger facilities also are better able to justify employing technicians to operate specialized equipment. Some scientists at small locations use research time to develop these skills. An additional advantage of fewer research locations is that it should require fewer area offices and less administrative support and overhead.

On the other hand, small research locations do allow for site-specific research. There are scientific reasons for conducting research in certain locales and not others, including (1) capacity to grow more than one crop in a growing season, (2) proximity to research problems, or (3) ability to contain disease organisms. These reasons may be a factor which in some cases overrides the interaction and efficiency issues. In these cases ARS could consider using cooperative agreements with State agricultural experiment stations, in conjunction with land-grant colleges and universities, to accomplish appropriate site-specific research. ARS has used such agreements successfully in the past.

Another factor to consider in any plans to close research laboratories is that ARS would be required to move or lay off Federal employees and to pay associated costs. According to ARS Western Regional Office officials, moving one employee costs between $12,000 and $15,000. These costs would have to be offset by the potential sales value or alternative use of unneeded

laboratories and any reduction in operating and maintenance costs. The costs would not include the cost to the employee of possibly moving to a higher cost-of-living area or having to pay a higher mortgage interest rate for a home. It is also difficult to place a price on the cost to morale of uprooting a scientist and family and redirecting the scientist's career.

Such a career change, according to ARS officials, may have long-range professional and financial repercussions to a scientist. Because much ARS research is long term, a scientist may work for several years to achieve publishable results. Publications are one element that supervisors consider when deciding to promote a scientist. Therefore, a scientist who starts new research as a result of a move and experiences the expected delay before publishing the results may not be promoted as soon as if the move did not take place.

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In our report, we recommended that the Secretary of Agriculture develop a plan to consolidate agricultural research activities at fewer locations, thereby allowing greater scientist interaction and more efficient use of equipment,

facilities, and administrative resources. We added that the plan also needs to address research priorities, personal and career plans of ARS employees, the costs of relocating employees, and the potential sales values or other uses of unneeded laboratories. We also recommended that the Secretary submit the plan to the appropriate committees of the Congress for their review and comments.

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This concludes my statement, Mr. Chairman. My colleague and I will be happy to respond to any questions.

Mr. SKEEN. Thank you very much, Dr. Gahr, and I want to apologize to Mr. Killian, who is accompanying you, and I am sure will be handy. I also want to recognize Ritchie Smith, who is with Mr. Calvani, who is the next witness.

Mr. Calvani is the next witness. He is the chairman of the Cotton Producers of New Mexico, New Mexico representative on the National Cotton Council Production Steering Committee.

Mr. CALVANI. I am Jerry Calvani, State chairman of the Las Cruces Cotton Producers of New Mexico, on whose behalf I appear today. The National Cotton Council Production Steering Committee is a central organization of the U.S. cotton industry, representing growers, ginners, warehousemen, cottonseed housemen, and manufacturers from California to the Carolinas.

Cotton is a renewable resource that is important to the Nation's agriculture and economy, compromising over 58,000 businesses—most of them small—and including farms and gins. Cotton provides nearly half a million jobs, more than one-third of the clothing for consumers, and 20 percent of the textiles used in home furnishings. Raw cotton experts for substantial each year in helping recruit our trade deficiency. Perhaps the best single entity is the $57 billion value of cotton and cottonseed products at retail.

Mr. Chairman, cotton like the rest of agriculture is really dependable upon research to remain a viable and strong industry. Under the effective system so unique to the U.S. research in this country is an efficient, proven, and complimenting melting are indeed with public programs management of the USDA Land Grant University Systems. Several studies document the high return to society in the public involvement and agriculture re-

search. The rates of return from crop and livestock investment range from 17 percent to 110 percent, averaging right at 50 percent, while the annual rate on cotton is 35 percent.

In recent years, however, the public investment in cotton and other agriculture research has lessened despite the just-cited high payoff for consumers of food and fiber products. We have been deeply concerned about this and so has the Congress by passing of Title 14 by quote the 1977 and 1980 artifacts.

Regional or national organizations strongly endorse expanding a research program. In unanimous resolution, they expressed conscious support for cotton programs conducted by the USDA, including Federal funds for cotton and cottonseed research that provide for efficient program growth to an adequate level, recognizing that such action is noninflammatory and will produce public health benefits far in excess of cost.

All segments of our industry recognize and support the need to reduce Government spending and inflation. For that reason, we have reluctantly accepted in recent years a no-growth agricultural research budget and a continuing decline in cotton share of research fundings with the expectations that funding for essential product would be provided in the future.

We believe the time has come to turn the situation around, and beginning research must be a part of the overall program. Keep in mind that cotton we producers grow and harvest has virtually no value unless it is singed. In 1982, there were over 2,200 ginning plants in the United States. Beltwise, farmers paid over $500 million for ginning services, accounting for about 10 percent of our production costs for funds. In addition, current ginning and associated cleaning technologies do not fully preserve inherent fiber and seed quality, therefore having the effect of increasing our costs.

Gins in New Mexico, the El Paso Valley of Texas, Arizona, and California processed approximately 37 percent of the total crop last year. A strong harvesting and ginning research program that addresses beltwide needs is important. However, many ginning research programs are not sufficient. The different genetic, vital ginnings are essential and often changing factors which must be considered in performing the precision research needed to advance the technology in ginning. In addition, various production and harvesting measures are employed across the belt, but these are not very static.

However, everchanging textile processing requirements and technologies also affect ginning needs. Therefore, viable ginning research programs must take into account the types of cotton being ginned, growing conditions, and the methods and conditions harvested. For maximum productiveness, laboratories should be as near as possible to research cotton on which research is conducted.

Beltwide, we have watched a number of ginning laboratories decrease from five to three with the closing of Oklahoma and South Carolina facilities about 10 years ago. In 1970 told ginning scientists years at all locations was 22. Now there are only 12. In 1970 a task force of over 100 scientists from USDA site experiment stations and the cotton industry examined ongoing and needed research programs for cotton as a whole. The study focused on research conducted on Government funds by the USDA and the task

force in its final report concluded that harvesting, ginning, and final preparation research was a top priority item and recommended a 20-percent program increase.

In the meantime, the number of ginning laboratories is at three USDA and has continued to decline. While we agreed to the need to the most efficient use of research funds, we do not see the wisdom or rationale of the guise and effectiveness or efficiency. Clearly there is a need for keeping an adequate funding for the three ginning laboratories that serve distinctly. A primary thrust of the laboratory here in Las Cruces is investigation into the technology of salt ginning, cleaning, and condition of longer staple irrigated up from cottons typical of the West.

The facility is also the only ginning laboratory actively conducting the important and highly specialized ginning research for extra long staple cottons. The ginning laboratory in Lubbock concentrates on and is typical of much of that grown in South Plains, while a double effort is directed toward a grain goal. The diversity and location of the three laboratories and the association they maintain with various State and other Federal laboratories have created a lab working relationship.

For example, a lab here is located on the edge of New Mexico State University campus. Such proximity is conducive to maintaining it. And while it is so important for the transfer of technology, generation of new ideas and professional development. You asked us to comment on how the joint use of federally supported research facilities might reduce the cost of running them, Mr. Hughs can testify this laboratory has already established a good working relationship with the university and with industry.

While the cotton industry has established an enviable record in its financial support to research, it cannot be expected to fund a larger portion. Even if it could afford it, the gains ultimately go to—it should, therefore, be clear that Government funds are both proper and essential for cotton researching, including ginning, is adequate to meet the needs that serve the products interest. When increased, approximately $70,000 is needed over the present budget and we strongly urge that this amount of program increase be provided as soon as possible in an orderly fashion.

Thank you very much, Mr. Chairman.

[The prepared statement of Mr. Calvani follows:]

Testimony of Jerry Calvani
New Mexico Chairman, Producer Steering Committee
National Cotton Council of America
before the
Subcommittee On Investigations And Oversight
of the
House Science And Technology Committee
Las Cruces, New Mexico
May 13, 1983

I am Jerry Calvani, cotton grower from Carlsbad, New Mexico and State Chairman of the Producer Steering Committee of the National Cotton Council, on whose behalf I appear today. The Council is the central organization of the U. S. cotton industry, representing growers, ginners, warehousemen, cottonseed crushers, merchants, cooperatives, and manufacturers from California to the Carolinas.

With me is Mr. J. Ritchie Smith, director of technical services for the Council. We will be glad to respond to any questions you may have after my presentation. We appreciate the opportunity to appear before you today.

Cotton, a renewable resource, is very important to the nation's agriculture and economy. Comprising over 58,000 businesses, most of them small and including farms and gins, cotton provides nearly half a million jobs, more than one-third of the clothing for consumers and 20 percent of the textiles used in home furnishings. Raw cotton exports are substantial each year and help in reducing our trade deficit. Perhaps the best single indicator of cotton's importance is the $53 billion value of cotton and cottonseed products at retail.

Mr. Chairman, cotton, like the rest of American agriculture, is highly dependent on research to remain a viable and strong industry. Under the effective system so unique to the United States, research in this country is an efficient and proven complementary melding of private R&D with public programs, mainly those in the USDA/land grant university system.

Several studies document the high returns to society from the public investment in ag research. The annual rate of return from crop and livestock research investments ranges from 17 percent to 110 percent, averaging right at 50 percent, while the annual rate on cotton is 35 percent.

In recent years, however, the public investment in cotton and other ag research has lessened despite the just cited high payoffs for consumers in food and fiber products.

We have been deeply concerned about this decline in research as has the Congress by its passage of Title 14 in both the 1977 and 1981 farm acts. At the Council's annual meeting in February, the 290 delegates selected by 90 separate state, regional, or national organizations strongly endorsed expanded agricultural research programs. In an unanimous resolution, they expressed continuing support for "...appropriations for cotton research and extension programs conducted by USDA and Cotton Belt states, including federal funds for cotton and cottonseed research that provide for efficient program growth to adequate levels, recognizing that such action is not inflationary and will produce public benefits far in excess of its costs."

All segments of our industry recognize and support the need to reduce government spending and inflation. For that reason, we have reluctantly accepted in recent years a "no-growth" agricultural research budget and a continued decline in cotton's share of research funding, with the expectation that funding for essential projects would be provided in the future. We believe the time has come to turn the situation around, and ginning research must be a part of the overall program.

Keep in mind, Mr. Chairman, that the cotton we producers grow and harvest has virtually no value until it is ginned. In 1982, there were over 2,200 ginning plants in the United States. Beltwide, farmers paid over $500 million for ginning services, accounting for about 10 cents of our production cost per pound. In addition, current ginning and associated cleaning technologies do not fully preserve inherent fiber and seed quality, thereby having the effect of increasing our cost.

Gins in New Mexico, the El Paso Valley of Texas, Arizona and California processed approximately 37 percent of the total crop last year.

A strong harvesting and ginning research program that addresses Beltwide needs is important. However, many ginning research problems are not universal. The different genetic, varietal and environmental conditions unique to various locations are essential and often changing factors which must be considered in performing the precision research needed to advance the technology of ginning. In addition, various production and harvesting methods are employed across the Belt, but these too are not static. Moreover, ever changing textile processing requirements and technologies also affect ginning needs. Therefore, viable ginning research programs must take into account the types of cotton being ginned, growing conditions, and the methods and conditions of harvest as well as textile demands on the fiber.

For maximum effectiveness, laboratories should be as near as possible to the source of cottons on which research is conducted. The benefits of local and regional stimuli are immeasureable.

Beltwide, we have watched the number of ginning laboratories decrease from five to three with the closing of the Chickasha, Oklahoma and the Clemson, South Carolina facilities about ten years ago.

In 1970, total ginning scientist years at all locations was about 22. Now there are only 12.

In 1979, a Task Force of over 100 scientists from USDA, state experiment stations and the cotton industry examined ongoing and needed research programs for cotton as a whole. The study focused on research conducted with government funds by the USDA and state agricultural experiment stations. In its final report, the Task Force concluded that harvesting, ginning, and fiber preparation research was a top priority item and recommended a 20 percent program increase.

Meantime, the number of ginning scientists at the three USDA labs has continued to decline. While we agree with the need for the most efficient use of research funds, we do not see the wisdom or rationale of closing additional cotton ginning laboratories under the guise of increasing effectiveness or efficiency.

Clearly, there is an urgent need for keeping, and adequately funding, the three ginning labs to serve the distinctly different production regions of the Belt.

A primary thrust of the laboratory here in Las Cruces is investigation into

the technologies of saw ginning, cleaning and conditioning the longer staple, irrigated upland cottons typical of the West. The facility is also the only laboratory actively conducting the important and highly specialized roller ginning research for extra long staple cottons whose U. S. production is solely in this area.

The ginning laboratory in Lubbock concentrates on the shorter staple, stripper harvested varieties typical of much of that grown in the South Plains, while the Stoneville effort is directed toward the rain grown, picker harvested medium staple cottons.

The diversity in locations of the three labortories and the association they maintain with various state and other federal laboratories have created a valuable synergistic relationship. For example, the lab here is located on the edge of the New Mexico State University campus. Such proximity is conducive to maintaining the academic/research environment so important for the transfer of technology, generation of new ideas, and professional development.

Mr. Chairman, you asked for us to comment on how the joint use of federally supported research facilities might reduce the cost of running them. As Mr. Hughes can testify, this laboratory has already established a good working relationship with the University and with industry.

While the cotton industry has established an enviable record in its financial support of research, it cannot be expected to fund a larger portion. Even if it could afford it, the gains ultimately go to the public rather than to producers or others in industry. It should therefore be clear that government funds are both proper and essential for cotton research, including ginning, that is adequate to meet needs and serve the public interest.

For optimum ginning research programs at the three labs, an increase of approximately $700,000 is needed over the present budget. We strongly urge that this amount of program increase be provided as soon as possible on an orderly basis.

Thank you Mr. Chairman for the opportunity to present our views.

Mr. SKEEN. Thank you, Mr. Calvani. We would like to start the questions at this point and appreciate the summarization that you folks have done with us. Congressman Durbin, would you like to begin the questioning?

Let me explain something to you. You get assigned to these committees. Many times you don't have any background information so you find yourself in a position of trying to become an overnight expert. And Dick said that the most cotton they raised in Illinois is in pharmaceutical bottle tops.

And I said, 'Well, I am on tobacco and peanuts over there, and the most tobacco we raised in New Mexico comes out of a little round can that most university students use in that little pinch between your cheek and gums, or whatever they call it."

I would like to ask Dr. Kendrick and Mr. Hughs—I want to give Mr. Hughs a chance to give us some kind of an assessment. By the way, I want to announce that copies of the GAO report that we have referred to are available outside. So any of you that would like to avail yourselves of those copies, please do.

Let me explain something else, too, so that we can kind of put this in perspective. The General Accounting Office is a branch of the legislature, the legislative branch of Government and not the administrative or the judicial. So it is our group. This is an agency that does the auditing work for the Congress of the United States.

They do an outstanding job and also one that is not particularly looked upon with a great deal of pleasure because they are always the devil's advocate. And in this political business, you soon realize that once you begin to challenge the use of any Federal bureau or agency, you are getting in deep water because it has a constituency, and starting in the Congress of the United States. They do an outstanding job, and I would cite, too—and I am sure that Mr. Gahr is aware of the fact—the GAO did a comparison analysis for us on the White Sands rancher placement work. We appreciate that very much.

But they are called upon to do these kinds of jobs and they do them very well and they do them in a very timely manner. You don't always agree with them, but at least they do this. It provides an opportunity to justify what we are doing with Federal funds in various areas, and I think that is extremely important.

And I appreciate Dr. Kendrick and Mr. Hughs being here this morning because it is an opportunity for the people who operate bureaus to respond and give what is their view of the need. That is what I would like to do this morning. I think that the thrust has been that because of understaffing and so forth, the lab is underutilized. And I would like to have Mr. Hughs' view on this.

You work in the lab?

Mr. HUGHS. Yes, sir. My name is Ed Hughs. I am research leader at the laboratory. Staffing—we currently have four scientists on the lab staff, counting myself. We do have an unfilled slot for another professional we cannot fill because of money limitations.

Let me comment a little bit. The thrust of this hearing is industry-Federal-private cooperation. The way we currently cooperate with the university is through their cotton breeding program. We have an ongoing relationship with the university in evaluating new strains of material that the cotton breeders come up with.

They want to look at that commercial-environment type of development without actual release to the public. And we can provide the expertise to evaluate these new varieties in large lots to give them the feedback information on what they need prior to releasing these varieties to commercial growers.

Recently we have been involved with the hybrid that has been developed here by Dr. Dick Davis and the stripper Acala varieties of Dr. Malm. The data is currently being put together. I think this is important in that the cotton industry is under pressure to constantly reduce costs and make their process more efficient. And these new varieties are important to the industry to be able to do both. If a variety is released, that cannot be ginned adequately then the farmer has problems. By "ginned adequately" I mean it cannot be ginned to get a good grade. The grade is what the farmer is paid for. If the grade is lower than an older variety, then you have lost money.

Some of the other areas that we are cooperating with industry—Mr. Calvani mentioned Cotton Inc. Cotton Inc. is currently funding an equivalent of 2 man-years approximately of technical expertise working on some of the problems of ginning redesign to improve the economics of the ginning operation. We think we can cut the verible costs of power at least in half with some of the things that we are working on. I could go into a lot more detail. I am not sure what you would be interested in.

Mr. SKEEN. Are you doing any work on the saline effectiveness of cotton plants and so forth, insofar as water quality problems?

Mr. HUGHS. Where we would fit in that work would be the cotton breeders would come up with a variety that they think has saline tolerance. They would grow these varieties and we would gin them for them and compare them to a standard, for example; Acala 1517-75 to determine ginnability and fiber quality.

Mr. SKEEN. Have you done some of this work?

Mr. HUGHS. We haven't at this point, no.

Mr. SKEEN. I know that the climate change had created a great deal of problems in cotton growing for a few years back, and then because of the recommendations that were made by the laboratory itself, you developed new shorter seasonal varieties. Have you been involved in that kind of evaluation and so forth?

Mr. HUGHS. The cotton breeders are always looking for short-season varieties, but still want to maintain the high quality that the Acalas are known for so we would evaluate the varieties that come up. And the stripper Acala variety is, I think, a plus in that direction.

Mr. SKEEN. We would lose a great deal of productivity where we used to make two bales to the acre. Several years running, it dropped off to a bale—less than a bale—if I am not mistaken. Is that right, Mr. Calvani?

Mr. CALVANI. Yes.

Mr. SKEEN. But the primary and the short-season variety have come from the agricultural research stations in this area; is that not correct?

Mr. CALVANI. Yes, that is. And with the two varieties that have been mentioned—shorter staple, shorter-season Acala variety, which is not a shorter staple. It maintains the same staple and also

with the hybrids that are being developed, you are also going to be able to do a lot of work in that area to make them a shorter season of cotton.

Mr. SKEEN. Is the productivity coming back up with these new varieties?

Mr. CALVANI. Yes.

Mr. SKEEN. But not to the point that we were enjoying for some years back?

Mr. CALVANI. Right. Where in 1964 we were enjoying.

Mr. SKEEN. Any other reasons for that?

Mr. CALVANI. Wish we knew.

Mr. SKEEN. I think that is one of the things it points out, the importance to this part of the country anyway, not just the State of New Mexico, but other States as well, that grow up in cotton of having that kind of facility available to us. And I am not arguing with the GAO report. There is also an economic basis, and I am glad that they have made this.

I notice that in a draft of the report that is entitled "Ginning Research Recommendations" that two options were given for changes to be made to the current agricultural research station cotton ginning research program. The first one was to redirect the Stoneville scientists and presumably support funds to the Las Cruces and Lubbock ginning labs. If the first option is not reasonable, why would phase I of the second option implement, Dr. Kendrick?

Dr. KENDRICK. Mr. Chairman, you say that was an assessment that was asked for by the managers within the Agricultural Research Service, and we went right to the program leaders.

Mr. SKEEN. So you responded to a direct——

Dr. KENDRICK. Then the program managers who have brought a response with regard to overall programs and so forth and so on assessed that information. And as I stated in my testimony, yes, what we really finally decided would be our ultimate goal of looking at the possibility of no increased resources as we would move toward a central laboratory. And in this case, rather than begin moving the Stoneville facility, our initial proposal would be well, let's consider getting on with consolidating the Lubbock and the Las Cruces program.

Remember, one of our bases for a central lab at Lubbock—and any time you begin to consolidate, you make some sacrifices and some compromises. But at Lubbock we had been moving into a total cotton production system. Down there we have agricultural engineers involved in the production cultural practices. We have cotton breeders. We have a base physiology program. We have grant scientists working with regard to the diseases, insects, and so forth. So the thought was OK. Go for a total program.

We believe in the three programs that we have. As you heard Mr. Calvani testify, we have retreated from five laboratories. We are down to three for a very specific purpose because we recognize they serve a specific need. You have three different areas.

I don't think the managers of the program thought at this point if you are going to move on, that it would be—we really weren't ready at this point to say we ought to dismantle the Stoneville Laboratory. It is a major research laboratory as far as replacement costs—Ritchie, you can back me up or question me on this—and

even education, but as a replacement cost, it would be most expensive.

I believe that the three laboratories have an approximate value of $14 million, and that facility there would be a $10 million facility to replace. Also—and Mr. Smith may want to comment on this—there could be some resurgence of some cotton acreage in the State with the success of the boll weevil eradication program. In the recognizance, I believe you are going to see some increase in cotton production certainly in North Carolina and I believe in South Carolina get some of those problems under way.

Also, we don't have water problems, you know, in the South and Southeast. We have plenty of water. We have got some other problem, but we think there will need to be some ginning research for that kind of cotton, at least in the near future. And the managers, yes, made some decisions when we said, "Well, if we are going to retreat to it, right now we move to try to go to build a central laboratory at Lubbock and then try to modify the Stoneville program as we could along the way."

Mr. SKEEN. In that line, I won't just keep belaboring the point, but you are talking about developing a lab, in going to the centralized concept that would be qualified. At the present time I would like to ask Mr. Hughs which of these labs involved now is probably the most qualified at the present time to handle that kind of testing of a wide number of varieties?

Mr. HUGHS. That is a hard question to answer, and I am not sure I am qualified. Three ginning labs serve the entire cottonbelt. I don't know what the production will be this year, but the year before last was like 14 million bales nationwide. Gin facilities are not too dissimilar through the belt other than the varities themselves and some of the problems are different. But a lot of the basic machinery is the same. We are the only ones that currently handle the Pima, the extra long staple problems. I really don't feel I am qualified to decide which lab would be best equipped. We all have our unique advantages due to location, staff, and equipment.

Mr. SKEEN. Mr. Calvani.

Dr. KENDRICK. If I could comment. You really put Mr. Hughs on the spot when you asked him that kind of a question because he is a research leader, interacts with the research leaders at these other three laboratories, and they are personneled very closely. It is an integrated program at these three ginning research laboratories, and he has an excellent program here. And so he is not going to downgrade the other programs. As I said, the only thing I would say is we think all three programs have a purpose, but if you move to a consolidated plant, then it is going to be some other people that are going to make that decision, not Mr. Hughs, because naturally, he will build the case deep. If we are going to have a central laboratory, let's have it here at Las Cruces.

Mr. SKEEN. Thank you, Dr. Kendrick. I didn't mean to embarrass anyone. However, I did want a response to a question from an individual who was going to be as objective as a scientist could be, and I think he handled it very well. I think he did an excellent job. He told me exactly what I wanted to know, and he did it in a very objective manner. So we have tested Mr. Hughs out, and Mr. Hughs handles his job very well. The best thing to do is to keep probing

around because it is a tough question. And when you have regional political differences, as we have across the board, we get asked embarrassing questions about why you won't give us a station, but you are asking us to give the same ones. You ask a scientist a question. Generally, I think, what they try to answer is what is the truth involved in the system? What is it that is going to serve us the best? And I think Mr. Hughs did an excellent job, and I appreciate the kind of response and I also appreciate the fact that it was a very uncomfortable question. But you handled it very well and you renew my faith in the scientific community.

Mr. Hughs, did you have another remarks?

Mr. Calvani, I have one last question and then I am going to complete this, because we are going to try to move it along. By the way, I want to ask if it would be all right, should we have any questions that should arise, could we submit them to any of you on the panel? That is a question I would also ask retrospectively for the first panel. I'm sorry they are not here, but we will give them a letter and submit the questions in writing.

Mr. Calvani, I was impressed with the fact that the research involved in cotton production has, in your estimation and your association's estimation, accrued some $53 billion in income, and I know we have had similar situations in the wool production programs that New Mexico State has helped us with, and with an involvement of 30 years and so on. Along the lines that we have set in this testimony today about cooperation, support from the private sector, has the association thought about assessments for funds for research coming from industry itself? If Mr. Smith would like to answer.

Mr. CALVANI. I will turn that over and let Mr. Smith answer that. He is a little more equipped to answer that question.

Mr. SKEEN. I mean to ask for supplementation from industry itself. I know you alluded to it in your testimony, but I would just like to ask you flat out: Has there ever been?

Mr. SMITH. Primarily through Cotton Inc., which is a cotton-producer-funded program based under a Federal law, the Cotton Research and Promotion Act which allows a check-off to speak of a little over $2 per bale that goes exclusively into cotton research and promotion and a percentage of that goes into research to supplement the basic program that is funded with the money from Federal and State sources.

In addition to that, through our cotton foundation, there is something like one-half a million dollars going into special projects, and this is all supplementary and complementary to the main effort which we think makes it more efficient and more effective. I would point out that with the economic conditions as they are and with most of the benefits flowing to consumers, as you gentlemen well know, it doesn't make economic or other kind of sense for industry people to put their own money into this kind of R&D because they can't retain the benefits and even get their investment back. So for that reason, there is a heavy reliance upon public funding and we have been concerned over the years because of a weakness of the Federal portion of the three-way system that has worked so well over the years in this country—private R&D and the State non-Federal programs, along with Federal.

The thing that has really declined in the last 15 years has been the Federal portion; the Federal funding of this whole system has come down, relatively speaking, and in that period of time, the cotton program, for example, has grown to 25 percent in the scientific years. So, this is the thing we think has to be restored, if we are going to have a continued strength in American agriculture and make the progress that we know we have got to have and in order to have the resources to fully utilize the facilities that are already out here, including one here on this campus.

Mr. SKEEN. Let me ask: How much does the commitment from industry amount to now and how is it shared among those areas that you are supporting, just basic research, not special projects?

Mr. SMITH. Through Cotton Inc.?

Mr. SKEEN. Yes, sir. How much does this amount to?

Mr. SMITH. Their budget this year is $18 million. For the last 2 or 3 years it has been close to $22 or $23 million.

Mr. SKEEN. This is on a marketing check-off?

Mr. SMITH. This is the dollar bale plus four-tenths of 1 percent.

Mr. DURBIN. I would like to make a statement for the record, and that is that I mentioned this last night, and Congressman Ron Coleman of El Paso wanted me to make it a matter of record here that he joins with Joe in supporting the continued use of the facility here in Las Cruces. I hope everyone appreciates that it goes beyond State borders, and that there are those who feel that this laboratory plays a key role in its regional aspect. I think, also, that the question should be asked if, in the existing facility there is an ability for a group like Cotton Inc. to contract with the facility for research? Is such a thing done either at Las Cruces or any other ginning laboratory?

Mr. SMITH. Mr. Hughs already mentioned some of the work that Cotton Inc. is supporting here, and I think that is typical of so many of the locations.

Mr. DURBIN. I want to make sure it is clear. My impression of Cotton Inc. was that it is primarily a marketing tool. But what I am learning this morning is it also has some research involvement with these laboratories directly; is that correct?

Mr. SMITH. That is correct.

Mr. SKEEN. Does the staff have any questions? Is there anybody in the general audience that would like to make a short comment?

I want to thank you gentlemen very, very much for your contribution to this hearing today, and I appreciate the long distance that some of you had to travel, and also the candor of your responses and the objectivity with which you have handled it.

Thank you very much.

Now we will have a short recess, and then I think we will start the third panel in about 10 minutes because we are rather pressed for time. So let's take about a 10-minute break.

[A brief recess was taken at 12 noon.]

Mr. SKEEN. The third panel in our hearing today is on the Rio Grande Research Corridor that we have heard about in our discussions. The third panel will discuss the plans for the Rio Grande Research Corridor and the technology. The first panelist is Mr. William Snyder, who is the director of nuclear fuel cycle programs at the Sandia National Laboratory in Albuquerque, N. Mex. The

second panelist is Dr. Harold Daw, associate academic vice president at New Mexico State University at Las Cruces. The third panelist is Dr. Koert Lessman, who is the director of the New Mexico Agriculture Experiment Station, New Mexico State University here in Las Cruces, and the last panelist is Mr. William Dutton, director of the Industrial Development Board in Las Cruces. We will start with you, Mr. Snyder.

STATEMENT OF A. WILLIAM SNYDER, DIRECTOR, NUCLEAR FUEL CYCLE PROGRAMS, SANDIA NATIONAL LABORATORY, ALBUQUERQUE, N. MEX.; DR. HAROLD DAW, ASSOCIATE ACADEMIC VICE PRESIDENT, NEW MEXICO STATE UNIVERSITY, LAS CRUCES, N. MEX.; DR. KOERT LESSMAN, DIRECTOR, NEW MEXICO AGRICULTURE EXPERIMENT STATION, NEW MEXICO STATE UNIVERSITY, LAS CRUCES, N. MEX.; AND WILLIAM DUTTON, DIRECTOR, INDUSTRIAL DEVELOPMENT BOARD, LAS CRUCES, N. MEX.

Mr. SNYDER. Thank you, Congressman Skeen.

[The prepared statement of Mr. Snyder follows:]

Testimony
before the
Investigations and Oversight Subcommittee
of the
U. S. House of Representatives
Committee on Science and Technology

Mr. Chairman and members of the Subcommittee, I am A. Wm. (Bill) Snyder. My professional position is Director of Nuclear Fuel Cycle Programs at Sandia National Laboratories in Albuquerque, New Mexico. For approximately the past year I have chaired the Study Group of the Governor's Committee on Technical Excellence. That Study Group authored the report, "Enhancing New Mexico's Leadership in High Technology Industry Development." I appear before this Subcommittee, grateful for the invitation and driven by a strong personal commitment to do what I can to mobilize the private, state, and federal assets in New Mexico for the purpose of developing quality industry, quality employment, and an improved economic quality of life. New Mexico has an opportunity, with a nearly unique set of assets, to be a test bed for organizational innovation to reverse the past regrettable trends which have erected barriers thwarting the contributions of governmental science and technology to U. S. products.

I acknowledge the Subcommittee's objectives in examining the joint use of federally supported research facilities by industry and universities, namely, (1) to reduce the tax payer's costs of running the federally supported research facilities, (2) to benefit the transfer of technology, and (3) to increase innovation and productivity. However, I perceive the situation in which some of these objectives could be

achieved while at the same time further aggravating the underlying cause of the erosion of the U.S.'s preeminence in spawning new technology that leads to the innovation and design of new products. The cause of that erosion, in my opinion, is the ever increasing federalization of the direction of research and development. The way in which research and development has been institutionalized in the period of the past two decades has (1) compelled the universities to compete under terms and conditions which are a contradiction to the proper and historical roles of universities, (2) it has impeded industries' reasonable access to new technology derived from nationally supported research and development, and (3) it has increasingly subjugated federal laboratories to the role of performing narrowly structured tasks specified by central authorities whose performance is measured by the frequency of attaining predictable outcomes. Research thus directed, with priority on high certainty of outcome, is no-risk research, a contradiction in terms. Universities, industries with research functions, and federal laboratories, the wellsprings of U. S. technological development and product innovation, have been increasingly straitjacketed by the central institutionalization of research and development.

Returning to the objective of joint use of federally supported research facilities to reduce the tax payer's costs of running the facilities, I seriously doubt that many industries will be motivated to contribute to the costs of running federally supported research facilities so long as the authority for the detailed direction of the uses of the facilities are vested in central authorities whose performance is measured against criteria which subordinate the effective application of the facility to the needs and purposes of

industry. Industry's justifiably jaundiced view of how too many federal facilities are now operated will not prompt many industry offers to share the costs.

Thus I perceive that the Subcommittee's goals should be reordered in priority. The keystone goal should be to enhance the collaborations and mutually reinforcing productivity of universities, industries, and federal installations. The barriers to such collaboration and mutual productivity should be greatly minimized, resulting in a U. S. triad for technological superiority in world markets. Immediate emphasis should be placed on a plan to change the institutionalization of research and development to a form in which the authority for the direction of research and development is vested in those who will be held accountable for the technical quality, quantity, and impact of research and development results. The currently exaggerated federalization of research and development has created the need for explicit technology transfer. Change the institutional arrangement, and the transfer of technology could occur effectively and implicitly. Change the institutional arrangement and another artifact of the federalization of research and development, namely, federally supported facilities needing industry contributions to reduce the tax payer's burden, could be solved. It's a symptom of the federalization of research and development that industrial and governmental research and development are regarded as distinct and nearly mutually exclusive functions. Clouding the distinctions by having industry contribute to the operating costs of federally supported facilities treats the symptoms but does not remove the cause.

Having argued my perception of the underlying problem which is retarding innovation and productivity, I want to examine the proposal of using New Mexico as a test bed for organizational innovation in order to return the U.S. to a condition of mutually reinforcing innovation and productivity by state and/or regional coalitions of industries, universities, and federal installations. This proposal embodies the theme which permeates the Study Group report and the Rio Grande Research Corridor concept. The success of the endeavor to enhance New Mexico's high technology industry development is keyed to the ability and willingness of industries, universities, and federal installations in New Mexico to work in concert to create new industries which are indigenous to New Mexico, because they are based on technology which is preeminent in New Mexico. The motivation of the three groups of participants to work in such mutually reinforcing roles will be greatly enhanced if the direction of research and development stems from the member participants and reflects local and regional conditions. Central direction, in contrast, is damaging to such coalitions for mutual productivity. Hence, it is damaging to technology transfer. Hence, it is an impediment to industries making any but token contributions to support the operations of federally supported research facilities.

Models for such regionalization, or state-level, coalitions can be offered. I know of none which have been tried. Some might allege that the North Carolina Research Triangle is an example of such a coalition; however, I observe that eventhough the Research Triangle has been a very notable success, it leaves mutually reinforcing innovations and productivity to a passive process of technology transfer. I envision in

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contrast a coalition which provides an active transfer of technology and an active entrepreneurial function. State governmental departments for economic development have tried to fill such a need. I don't perceive that these attempts have been notably successful. In all such examples, the federally supported research facilities stand apart from the regional universities and industries. Should we consider, for example, a not-for-profit, joint subsidiary, in form, involving industries, universities and contractors of government-owned, contractor-operated federal supported research facilities to foster mutual effectiveness? I pose this question to motivate thinking along new directions to succeed where current attempts are failing. I can give "ten reasons" which will be offered, why this proposal isn't workable. I submit, however, that the key to success is in finding "one reason" why an idea can be made to work. The U. S. is highly productive in technological innovation; we are, however, in dire need of organizational innovation to save us from the shortcomings of our current institutionalization of research and development which is denying the U. S. its potential advantages in world markets.

Mr. SKEEN. Thank you very much, Mr. Snyder.

The next presenter is Dr. Harold Daw.

Dr. DAW. Hon. Joe Skeen and Hon. Richard Durbin, I am delighted to have the opportunity to present testimony before you relative to the subject of this hearing having to do with the joint use of federally supported research facilities and matters related thereto. I do want to thank you, Representative Skeen, for having read in President Thomas' statement welcoming you to New Mexico State.

Mr. SKEEN. We thank him for the statement, too.

Dr. DAW. First of all, I would like to point out that New Mexico State University is currently ninth in the Nation of University Department of Defense contractors and, therefore, NMSU has a keen interest in interactions between the universities and the Federal Government. It is estimated that our research and public service budget for next year will be at $75 million level. For us, research is important business. I am attaching a copy of a research statement on New Mexico State University and will not cover it in my verbal presentation.

Our research and public service budget comes, for the most part, from Federal and private sources with a smaller amount from State appropriations. Thus our interactions with the Federal Government and the private sector is extensive. There are a number of examples on the campus of where this interaction has borne substantial fruit. Before covering those, however, let me point out that Senate bill 338, Modifying the Federal Purchasing Act, would preclude any sole sourcing between the Government and universities. We think this is serious as it relates to research and recommend

that such changes in the Federal Purchasing Act give recognition to the particular nature of research so that the Federal Government might continue to sole source with universities.

Let me give you some examples of interactions between the universities and Government and industry which have shown substantial promise. A number of years ago the Air Force had an aeromedical laboratory at Holloman Air Force Base. About 1970, the Air Force was instructed to divest itself of such research activity and the aeromedical laboratory became the International Center for Environmental Safety under Albany Medical College in New York. In 1980, New Mexico State University acquired this center from Albany. This center is now known as the Primate Research Institute of New Mexico State University located on Holloman Air Force Base and uses buildings which were surplus or excess to the needs of the air base. The cooperation between NMSU and the Air Force has been most cordial. A number of the chimpanzees at the center still belong to the Air Force, currently about 70. We manage 390 chimpanzees nationwide and have 245 onsite. In addition, we have about 300 monkeys. In addition, we brought in $600,000 this quarter and expect $2 million next year from industry. We receive about $700,000 from the Federal Government, particulary the Food and Drug Administration. These animals and this institute have been vital in the area of hepatitis research, are contributing to the herpes simplex II problem, and may possibly become involved with AIDS.

A year ago, the congressional delegation was instrumental in providing $500,000 for the care and maintenance of these animals and we are now asking for $500,000 more to see that this national resource is properly cared for. If we move to handle AIDS, we will be seeking an additional $2 million. Our relations with the Air Force have been extremely good and it is, as I mentioned, giving an important additional adjunct to New Mexico State University research. The Primate Research Institute has been responsible for bringing a new toxicology company to Las Cruces.

A second area of major effect relative to a joint university government relation leading to industry has been our geothermal program. Funding for geothermal research and geothermal surveys of New Mexico was provided by the Department of Energy as well as by our State government. This research was directed from New Mexico State University. The result of the research established that the entire east mesa stretching for nearly 40 miles from the Texas-New Mexico border to Radium Springs in Dona Ana County has substantial direct use geothermal energy. Temperatures range from 214 degrees Fahrenheit down to something in the neighborhood of 118 degrees Fahrenheit. Much of the resource is at about 1,000 feet, but some locations have almost surface exposure.

The campus geothermal system itself has the capability of supplying 10 million Btu's per hour to the campus hot water heating system. The campus installation and necessary research was carried out with both Department of Energy funds and State funds. A number of meetings have been held bringing together community people, industrial people, and geothermal owners to bring about the development of a greenhouse and food processing industry in this area of the State.

Recently the Federal regulations dealing with geothermal were modified so that greenhouse and food processing application may be located on BLM land adjacent to the geothermal energy source. This extends the previous regulation which would allow electrical generation at the geothermal site. This is a very important development relative to commercialization of the discovered geothermal energy.

A new incentive has been established in New Mexico which will have important consequences. This is the Rio Grande research corridor.

The corridor has been described by Bill Snyder of the Sandia Corp. and New Mexico State University, as indicated, is participating in this corridor, anchoring its southern end, and will create two centers of excellence, one in computer applications and a second in genetic engineering.

Let me say a few words about each of these centers and the procedures we are now going through to bring these centers about. We wish these centers to be truly world class. As we move forward to hire directors for each of these programs, we are inquiring of the best people we can identify to give us advice on our proposed directions.

We expect to form advisory committees drawing from the leaders in academia, the leaders in Government, and the leaders in industry to give continuing direction and to evaluate the progress we make. This will require extensive cooperation from the private sector but, in addition, would not have been possible and will not be possible without the strong support of the technical community currently in the State, namely, Los Alamos, Sandia, the Air Force Weapons Lab, the White Sands Missile Range, the NASA facility, TDRSS, and so on. And as these centers of excellence are built, all of these entities will benefit from the capability that is established here. In addition, we are hoping that it will have a major effect on the relocation or expansion of companies in the high tech area into the State. The Computer Applications Center will draw on the expertise already existing on the campus in computer vision, robotics, artificial intelligence, computer-aided design, and so forth. The Genetic Engineering Center will focus mainly on the plant area and those aspects of plant genetics related to our semiarid environment. Here also we have a substantial base on which to build. In both areas, the focus will be on excellence.

As we move ahead in these areas, and particularly in computer applications, it will be vital to tie the State's computer areas together. We expect to participate in bringing this about. It is anticipated that a communications trunk will be created which will tie together the university, governmental laboratory, and industrial concerns along the research corridor. This will be a great step forward if the various entities and their computers can be tied together for transmittal of data and exchange of data and for video transmission to provide for conferencing, for instructional programs, and so forth. I might mention a number of companies have been instrumental in bringing this about, by donating equipment, and we very much appreciate that. And I am not sure whether I will read their names into the record or not. I should comment in relation to the matter of excellence at universities which was considered extreme-

ly important by the study committee has come under some attack on occasion by people within the State. Bill Dutton, who you will hear from later, called me about an article by Lawrence Ingrassia in the Wall Street Journal on Thursday, May 12—and I will not read that now since he is going to read that—but it is exciting, relative to how companies are viewing the importance of excellence in universities relative to their programs.

The existence of the Southwest Residential Experiment Station, dealing with residential photovoltaics, supported by DOE, is likely to have major consequences for the growth of the photovoltaic industry in the State of New Mexico. I think there is no doubt that the cost of photovoltaics will come down, and as the cost comes down and becomes competitive with other forms of electricity, we will see many, many new innovative uses occurring. Some of these uses will be the kinds of things one might anticipate, such as photovoltaics on houses to generate part of the electricity. But I think one will then begin to see photovoltaics providing power to locations that currently cannot afford power and to new kinds of industry developing in locations one had not anticipated before. If the cost could be lowered enough, photovoltaics could then solve a serious problem for farmers in reducing the cost of pumping irrigation water. It could mean the salvation to some farming areas which may have to cease farming simply because of energy costs.

Along with all of the benefits we enjoy relative to government regulations, there are some problems that arise. Universities are continually under attack to reduce the indirect cost expense, and I might here add that indirect costs are real costs. They are not direct charges simply because the variety of these charges makes it more convenient to lump them together as indirect costs. The National Institutes of Health would like to just arbitrarily reduce indirect cost 10 percent, not a wise thing to do. The Government continually passes regulations which raise the indirect costs. An example is regulations dealing with disposal of chemical waste. NMSU has put into the program for handling chemical waste in the last 2 years $193,000. During this time, we have shipped to a location in east Texas, because there is no repository, 2,700 pounds of chemicals. We currently have on hand 7,200 pounds of chemicals. If one totals these together and divides by the amount of money that we have put into the chemicals, one can see that for the handling of routine chemicals at the university, the cost of taking care of the waste so far is the same order of expenditure as the cost of the chemicals in the first place.

I think it is highly important that we establish, between the universities, the Federal Government, and industry, a sense of trust of each other. The matter of accountability may have gone too far. In attempts to see that no abuse occurs, we have hampered much of the truly creative research, and we need to return somewhat to the matter of trust and then take action on the violators rather than passing new rules which hamper the overall work.

We are excited about the future, and we also believe that there are some functions of government which are essential. The care of aged parents can be returned to the family, but research is not one of the matters that can be left to State and local governments or families. The States are barely able to fund research in a minor

way, and research which leads to new inventions, to new industry, to increasing our competitive position with other countries, largely must be supported by the Federal Government. Some research support to universities can come from industry. It would be greatly accelerated by increased tax benefits for industrial support of research at universities. But the Government has difficulty dealing with keeping things proprietary for industry, and furthermore, such proprietary matters, while not impossible for universities, impose on universities particular constraints. So while it may be important to increase the degree to which industry supports research within universities, it is also vitally important to remember that most of the truly innovative, creative kinds of research—basic research—will have not come from universities and will have to be nationally supported because of the cost. It is this basic research which provides the truly new initiatives for future technological and social progress.

Thank you.

[The prepared statement of Dr. Daw follows:]

Committee on Science and Technology
Investigations and Oversight Subcommittee

TESTIMONY FOR FIELD HEARING
May 13, 1983
by Dr. Harold A. Daw

Honorable Joe Skeen, I am delighted to have the opportunity to present testimony before you relative to the subject of this hearing having to do with the joint use of federally supported research facilities and matters related thereto. First of all, I would like to point out that New Mexico State University currently is ranked 9th in the nation of university Department of Defense contractors and therefore NMSU has a keen interest in interactions between the universities and the federal government. It is estimated that our research and public service budget for next year will be at the $75 million level. For us, research is important business. I am attaching a copy of a research statement on New Mexico State University and will not cover it in my verbal presentation.

Our research and public service budget comes, for the most part, from federal and private sources with a smaller amount from State appropriations. Thus are interactions with the federal government and the private sector is extensive. There are a number of examples on the campus of where this interaction has borne substantial fruit. Before covering those, however, let me point out that Senate Bill 338, Modifying the Federal Purchasing Act, would preclude any sole sourcing between the government and universities. We think this is serious as relates to research and recommend that such changes in the federal purchasing act give recognition to the particular nature of research so that the federal government might continue to sole source with universities.

Let me give you some examples of interactions between the universities and government and industry which have shown substantial promise. A number of years ago the Air Force had a aeromedical laboratory at Holloman Air Force Base. About 1970, the Air Force was instructed to devest itself of such research activity and the aeromedical laboratory became the International Center of Environmental Safety under Albany Medical College in New York. In 1980 New Mexico State University acquired this center from Albany This center is now known as the Primate Research Institute of New Mexico State University and is located on Holloman Air Force Base and uses buildings which were surplus or excess to the needs of the air base. The cooperation between NMSU and the Air Force has been most cordial. A number of the chimpanzees at the center still belong to the Air Force, currently about 70. We manage 390 chimpanzees nationwide and have 245 on site. In addition we have about 300 monkies. In addition, we brought in $600,000 this quarter and expect $2,000,000 next year from industry. We receive about $700,000 from the federal government, particularly the Food and Drug Administration. These animals and this center have been vital in the area of hepatitis research and

are contributing to the herpes simplex II problem and may possibly become involved with AIDS.

A year ago the Congressional delegation was instrumental in providing $500,000 for the care and maintenance of these animals and we are now asking for $500,000 more to see that this national resource is properly cared for. If we move to handle AIDS, we will be seeking an additional $2 million. Our relations with the Air Force have been extremely good and it is, as I mentioned, giving an important additional adjunct to New Mexico State University research. The Primate Research Institute has been responsible for bringing a new toxicology company to Las Cruces.

A second area of major effect relative to a joint university government relation leading to industry has been our geothermal program. Funding for geothermal research and geothermal surveys of New Mexico was provided by the Department of Energy as well as by our State government. This research was directed from New Mexico State University. The result of the research established that the entire east mesa stretching for nearly 40 miles from the Texas-New Mexico border to Radium Springs in Dona Ana County has substantial direct use geothermal energy. Temperatures range from 214°F down to something in the neighborhood of 118°F. Much of the resource is at about 1,000 feet but some locations have almost surface exposure.

The campus geothermal system itself has the capability of supplying 10 million btu per hour to the campus hot water heating system. The campus installation and necessary research was carried out with both Department of Energy funds and State funds. A number of meetings have been held bringing together community people, industrial people and geothermal owners to bring about the development of a greenhouse and food processing industry in this area of the State.

Recently the federal regulations dealing with geothermal were modified so that greenhouse and food processing application may be located on BLM land adjacent to the geothermal energy source. This extends the previous regulation which would allow electrical generation at the geothermal site. This is a very important development relative to commercialization of the discovered geothermal energy.

A new incentive has been established in New Mexico which will have important consequences. This is the Rio Grande Research Corridor. The corridor has been described by Bill Snyder of the Sandia Corporation and New Mexico State University, as indicated, is participating in this corridor anchoring its southern end and will create two centers of excellence, one in computer applications and a second in genetic engineering.

Let me say a few words about each of these centers and the procedures we are now going through to bring these centers about. We wish these centers to be truly world class. As we move forward to hire directors for each of these programs, we are inquiring of the best people we know, who are the best people they know. We are expecting to bring several consultants from among the best people we can identify to give us advice on our proposed directions. We expect to form advisory committees drawing from the leaders in academia, the leaders in government, and the leaders in industry to give continuing direction and to evaluate the progress we make. This will require extensive

cooperation from the private sector but in addition would not have been possible and will not be possible without the strong support of the technical community currently in the State, namely Los Alamos, Sandia, the Air Force Weapons Lab, the White Sands Missile Range, the NASA facility, TDRSS, and so on. And as these centers of excellence are built, all of these entities will benefit from the capability that is established here. In addition, we are hoping that it will have major effect on the relocation or expansion of companies in the high tech area into the State. The computer applications center will draw on the expertise already existing on the campus in computer vision, robotics, artificial intelligence, computer aided design, etc. The genetic engineering center will focus mainly on the plant area and those aspects of plant genetics related to our semiarid environment. Here also we have a substantial base on which to build. In both areas the focus will be on excellence.

As we move ahead in these areas, and particularly in computer applications, it will be vital to tie the state's computer areas together. We expect to participate in bringing this about. It is anticipated that a communications trunk will be created which will tie together the university, governmental laboratory, and industrial concerns along the research corridor. This will be a great step forward if the various entities, and their computers, can be tied together for transmittal of data and exchange of data, and for video transmission to provide for conferencing, for instructional programs, etc.

The existence of the Southwest Residential Experiment Station, dealing with residential photovoltaics, supported by DOE, is likely to have major consequences for the growth of the photovoltaic industry in the State of New Mexico. It think there is no doubt that the cost of photovoltaic will come down, and as the cost comes down and becomes competitive with other forms of electricity we will see many, many new innovative uses occurring. Some of these uses will be the kinds of things one might anticipate, such as photovoltaics on houses to generate part of the electricity. But I think one will then begin to see photovoltaics providing power to locations that currently cannot afford power, and to new kinds of industry developing in locations one had not anticipated before. If the cost could be lowered enough, photovoltaics could then solve a serious problem for farmers in reducing of the cost of pumping of irrigation water. It could mean the salvation to some farming areas which may have to cease farming simply because of energy costs.

Along with all of the benefits we enjoy relative to governmental regulations, there are some problems that arise. Universities are continually under attack to reduce the indirect cost expense and I might here add that indirect costs are real costs. They are not direct charged simply because of the variety of these charges makes it more convenient to lump them together as indirect costs. The National Institutes of Health would like to just arbitrarily reduce indirect cost 10 percent. Not a wise thing to do. The government continually passes regulations which raise the indirect costs. An example is regulations dealing with disposal of chemical waste. NMSU has put into the program for handling chemical waste in the last 2 years $193,000. During this time we have shipped to a location in east Texas, because there is no local repository, 2,700 lbs. of chemicals. We currently have on hand 7,200 lbs. of chemicals. If one totals these together and divides by the amount of money that we have put into the chemicals, one can see that for the

handling of routine chemicals at the university, the cost of taking care of the waste, so far, is the same order of expenditure as the cost of the chemicals in the first place.

I think it is highly important that we establish between the universities and the federal government and industry a sense of trust of each other that the matter of accountability may have gone too far, that in attempts to see that no abuse occurs, we have hampered much of the truly creative research and that we need to return somewhat to the matter of trust and then take action on the violators rather than passing new rules which hamper the overall work.

We are excited about the future, and we also believe that there are some functions of government which are essential. The care of aged parents can be returned to the family, but research is not one of the matters that can left to State and local governments or families. The states are barely able to fund research in a minor way and research which leads to new inventions, to new industry, to increasing our competitive position with other countries, largely must be supported by the federal government. Some research support to universities can come from industry. It would be greatly accelerated by increased tax benefits for industrial support of research at universities. But the government has difficulty dealing with keeping things proprietary for industry, and furthermore such proprietary matters, while not impossible for universities, impose on university particular constraints. So while it may be important to increase the degree to which industry supports research within universities, it is also vitally important to remember that most of the truly innovative, creative kinds of research, basic research, will have to come from universities, and will have to be nationally supported because of the cost. It is this basic research which provides the truly new initiatives for future technological and social progress.

Thank you.

Harold A. Daw

RESEARCH AT NEW MEXICO STATE UNIVERSITY

New Mexico State University is New Mexico's land-grant university and its oldest institution of higher education. It currently enrolls 12,500 students of which 1,625 are at the graduate level. The school prides itself in excellence in teaching as well as excellence in research.

Doctoral degrees are granted in 19 areas. The Ph.D. is awarded in agronomy, astronomy, biology, chemistry, computer science, mathematics, physics, psychology, civil engineering, electrical engineering, mechanical engineering, counseling and guidance, curriculum and instruction, educational management and development, animal science, and range science. The doctorate of education is awarded in the three educational areas as well as the Ph.D. Since 1960 over 600 doctoral degrees have been awarded. The Educational Specialties degree is offered in four areas. Master's degrees are awarded in 39 areas and the baccalaureate is awarded in 93 areas.

New Mexico State University anchors the southern end of the Rio Grande Research Corridor and has been designated and funded by the State of New Mexico to develop two centers of technical excellence, one center in the area of computer applications and a second center in the area of genetic engineering for semiarid environments. This corridor will be a part of a Statewide program which will draw on the strength already existing in the universities, testing federal laboratories and other facilities, e.g. Sandia National Laboratory, Los Alamos National Laboratory, White Sands Missile Range, NASA White Sands Facility, Telemetry Data Relay Satellite System, to make the Rio Grande Valley a major high technology region.

Research has played an increasingly important role at NMSU. Expenditure for research and public service (most of which is research) for 1981-82 was $55 million in a total main campus budget of $135 million. The dollar value of current contracts in force, a number of contracts for multiple years, is on the order of $150 million. The estimated research and public service for 1983-84 is $75 million.

The State of New Mexico has supplied $2 million per year for the last 4 years for equipment purchases in the science and engineering areas. This has permitted the institution to upgrade its capabilities in a number of areas.

The university has computer support as follows: universitywide, an Amdahl 470 V5 and an Amdahl 470 V6; engineering, 2 VAX 11-780's; the Physical Science Laboratory, an IBM 4341 and a VAX 11-780; physics, a PDP 11-60. Other departments have a number of miscellaneous computers. Much of NMSU's computing is online and a total of 460 terminals are available. In addition, over 360 micros are in use.

New Mexico State University carries out its research mission through research centers, stations, institutes and laboratories organized around particular areas.

The Agricultural Experiment Station conducts a program of basic and applied research over a broad area from rural living to consumer health and nutrition. In addition to the main campus operation, eight research farms and two ranches are maintained.

Many educational service and development entities are contained in the Educational Research Center. Among them are: the Dove Learning Center, the Bilingual-Bicultural Education Unit, ERIC-CRESS, the University of Wyoming's Infant Stimulation Program, the Preschool for the Gifted, three integrated preschools of handicapped with non-handicapped children, the Self-Assessment Responding Project and the Expanding Educational Opportunities for Rural Youth Project.

The Center for Business Services provides business and economic research services to the public and private sectors. The center also provides management services. Its research capabilities are in the areas of behavioral and managerial science, busines systems, economic and social systems, manpower, marketing and regional planning.

The Engineering Research Center coordinates and promotes scholarly research in chemical, civil, electrical and computer, industrial, and mechanical engineering. Although its current contract and grant activities address over two dozen individual research topics, there are four particular centers with significant concentrations of faculty research strengths. These are the Center for Biochemical Engineering Research, the Center for Transportation Research, the Center for Electronic Vision and Robotics, and the Center for Thermal Engineering Research. In the past several years, outside support of engineering research has grown at an average of 14 percent annually, with about 70 percent of the funds from federal government sources. Close ties exist between the College of Engineering research faculty and New Mexico's federal laboratories.

The Arts and Sciences Research Center promotes and provides support for the broadest spectrum of research and scholarly activity within the university. In addition to the typical and more traditional scholarly activities in the fine arts, humanities and social and physical sciences, there are strong research programs in such areas as long term ecological research, computer applications, aviation research, geophysics, applied mathematics, and environmental research.

The Water Resources Research Institute was established to bring a concentrated Statewide research effort to bear on the State's complex water and environmental problems. While its headquarters are located on the NMSU campus, the research activities are conducted at all of the State universities.

The NMSU Cooperative Extension Service is a vehicle to deliver research results to every county in the State. Whether the need is in the area of food and nutrition, agricultural and livestock management, engineering, or a myriad of other activities, NMSU is there to serve you.

The New Mexico Solar Energy Institute has moved to lower barriers and enchance incentives to using the sun as a substitute for depletable

fossil fuels. A proposed State solar plan has been drafted which envisions construction of some 20,000 houses by 1985 with solar heat or hot water.

The Southwest Residential Experiment Station a part of the Solar Energy Institute and one of 3 such stations in the U.S., is located on the campus. This station does research on residential photovoltaics. Nine U.S. companies have prototype structures under test at the present time at this facility.

The Energy Institute at NMSU has promoted research in the field of alternate energy throughout the State. Its current efforts are mainly centered in the geothermal area. This research covers the State but has been particularly successful in Dona Ana County of southern New Mexico where NMSU is located.

The Primate Research Institute of New Mexico State University is located at Holloman Air Force Base just outside of Alamogordo, New Mexico. It has the largest captive breeding colony of chimpanzees in the world, as well a large number of rhesus monkeys and other primates and lesser animals. It does extensive research in hepatitis toxicology, metabolic chemistry, and etc. It does work both for governmental and private agencies.

The Center for International Programs receives major attention at NMSU. This institution is the lead university, in cooperation with the Consortium for International Development, consisting of 11 western universities, on projects in Egypt (major cereal grain), Yeman (secondary agricultural education), and recently added Honduras (farming systems).

The Physical Science Laboratory is an important adjunct to NMSU. The work in this laboratory is primarily related to DOD and NASA. Because of this work, NMSU ranks 9th in the nation of university DOD contractors. The laboratory is capable of large electronic systems integration such as land based and mobile sea ranges, laser data gathering systems, and satellite communication systems.

For: Field Hearing
May 13, 1983

Committee on Science and Technology
Investigations and Oversight Subcommittee

BIOGRAPHICAL SKETCH

Dr. Harold Daw is currently an Associate Academic Vice President at New Mexico State University and coordinates research activities at the university. He received his Ph.D. from the University of Utah in 1956 in the area of physics and in the process did graduate work both at the University of Utah and Johns Hopkins University. He is a member of Phi Beta Kappa, Phi Kappa Phi, and Sigma Xi. He holds the Robert Andrews Millikin Award for creative teaching in physics. He has been at New Mexico State University since 1954, serving in that time as a member of the physics faculty, head of the physics department, acting and associate dean of arts and sciences, and a vice president. He has published a number of papers and has invented several pieces of physics instructional apparatus which are nationally marketed.

Mr. SKEEN. Thank you, Dr. Daw. The next presentation is from Dr. Lessman.

Mr. LESSMAN. Congressman Skeen, Congressman Durbin, I am certainly pleased to be a participant in these hearings today. I am going to deviate a little bit from my written statement, and I hope that it will assist you in what we consider to be some of our uniquenesses.

We in agricultural research have a history, we think, if not a way of life, of joint use of facilities, even cooperation with ranchers, growers, and so forth. We have a history of cooperation with other scientific groups, and we expect that this capability and the experience that we have will be invaluable as concepts like the Rio Grande Corridor come into our midst. So I would like to just briefly go over some of our experiences with you and talk a little bit about where we think our government may play a role in the future of this cooperative type of work.

We go back, of course, in agricultural research, to 1887 when Congress spurred research for bettering agricultural methods through the enactment and expansion of the Hatch Act, providing Federal funds for support to the agricultural experiment stations. And I would be remiss if I didn't say it's certainly my belief that it's the envy of the world. Other countries seek our guidance in this and use of our systems. It's a good system.

Over the years, we have had what we consider some outstanding cooperative efforts with Federal facilities and some private facilities. I can't mention them all, but I am going to touch on a few of these.

One of these—it stands out quite vividly in my mind—is the Jornada Experimental Range, which is adjacent to the New Mexico State University College Ranch. The Cotton Ginning Laboratory also was alluded to. I am only rushing over that as we go through this. And then we have something quite new to this, and that's our tissue culture laboratory for New Mexico.

Briefly, the Jornada Experimental Range is, of course, a Federal installation, and it is to some of us quite a beautiful setting; to others, I don't think we truly appreciate it. It is at the southern entrance to the Jornada Del Muerto in southern New Mexico. Together, the two research areas cover about 104,000 acres of New Mexico rangeland.

Soil and climate are so typical of some 30 million acres of semidesert range in the Southwest, or an area, if you like, about the size of the whole State of New York. We are talking about an appreciable area in which we are attempting research methods to utilize this effectively.

To give you a feeling, from the Midwest, Congressman Durban, 1 acre of cultivated pastures in the State of Illinois would feed a critter for a full season. Here in our area, an average acre may keep her fed 1 or 2 days. So, we have particular challenges and capabilities.

Since 1927, researchers at the Jornada and the college ranch have worked together in an effort to find solutions to problems facing southwestern ranchers. Currently, this involves seven Jornada range scientists and a multidisciplinary team of about 17 university research scientists.

Recent cooperative studies have focused on range improvements and animal management. Range scientists are using mechanical and chemical controls on brush and looking at the long-term impacts of grazing on grasses over the past 50 years. Animal scientists are investigating various aspects of sheep production, beef crossbreeding, and the effects of using irradiated sewage sludge as potential feed supplement for livestock. This would be significant if we are able to harvest and put them to use. We also think that these long-term grazing impacts of over 50 years are of significance and must be continued.

The semiarid ranges have attracted scientists and students from many disciplines and from most world grazing areas. The disciplines include animal and range scientists, botanists, zoologists, soil microbiologists, entomologists, wildlife scientists, soil scientists, and geographers.

Nearly 400 publications have resulted directly from Jornada and college ranch research activities, and about 75 of these and dissertations have come from student projects. Private industry has recognized the importance of unique research potentials on the Jornada Experimental Range and the college ranch and has contributed funds and materials to aid in the research effort.

The Southwest Cotton Ginning Research Laboratory is one of three cotton ginning research laboratories in the United States. It is the only laboratory in the Southwest, and the only one equipped with a roller gin for processing long-staple Pima cotton. As such, the laboratory serves a four-State southwestern area cotton industry with an annual upland cotton production value of $2.8 billion and an annual Pima cotton production value of $54 million.

Researchers at the laboratory have been key support people in several important research breakthroughs in cotton production and marketing, including testing of the Acala variety of cotton, which is the foundation variety for the superior yielding and quality cotton grown throughout the Southwest. I wanted to mention its

value to our breeding program in which they have played a role in ginning our new varieties, and particularly now with the new hybrid cotton that's coming.

I would be remiss if I did not mention to you that your New Mexico State University is the first one to develop a hybrid cotton. We have a few piddly things to overcome, but the previous tests and so forth have shown approximately a 30-percent yield production. We are talking about one bale versus two bales. We feel there is an impact. So, we next may move into the tissue culture program that we have going and how it may fit into the process of the Rio Grande corridor and the plant genetics laboratory that Dr. Daw has mentioned.

The tissue culture lab at New Mexico is a research facility researched by a Federal researcher and a university researcher, is a joint venture of Federal and State Governments and private industry in terms of funding. That has been a project in which industry has contributed support funds, the Federal Government has contributed scientific help and funds and the State, to make it possible to have a tissue culture facility.

Both are developing culturing techinques for haploid plant production. This is one of the major techniques that we have. If this is sucessful in the plant breeding world, we should be able to cut the time to produce a haploid about 50 percent. So, these are some of the far-reaching objectives of this kind of capability.

In addition, we truly believe that the tissue culture facility that we now have has been a factor in New Mexico State being chosen for the Rio Grande corridor, and we fully believe that our in-house expertise can effectively participate in this program. In fact, at this point we have had several contacts already, which are probably premature, from private industry to participate in this lab capability.

We are quite excited about that. Now, however, I must mention that these efforts over the years have cost us some money. We always seem to get around to money when we want to talk about research and other programs, and I need to point out to you the involvement of the United States, the Federal Government, and the State-Federal partnership in all of these kinds of things. They are important because their dependability lends stability to the experiment station research program.

Most projects are of 3 to 10 years' duration. We believe this Federal support is a major factor in the past successes of agricultural research in the United States, and I fully expect it to become even more critical in the future. As private industry becomes involved, they must have something to bounce some of their more short-term research needs off of a dependable program of continuity and visibility in order to relate to the concept of the Rio Grande corridor, I feel certain.

Unfortunately, experiment stations—not only ours, but across the Nation—are experiencing a destabilizing trend in funding. They have shown little change since 1967 in terms of real dollars. In current dollars it appears that cooperative research has increased more than tenfold since 1960.

In 1967 dollars, we adjust them for inflation appropriations from 1960 to 1967 increased nationwide from about 30 million to about

65 million or 1½ million per year. Since 1967, the increase has been about $3 million per year or almost level. This is becoming a major factor in maintaining the research capability and the food and fiber production capability in our country.

Our experiment station here in New Mexico has experienced an actual decline in constant dollars of the important Federal formula funds allocated to us since the 1976-77 fiscal year. In comparison with other sources of funds, our State appropriations in constant dollars increased 23 percent over a 6-year period to the current fiscal year. Other grants increased 108 percent, and Federal formula funds declined 38 percent.

Our scientists in agriculture are competitive and seeking funding from other sources, and I believe sincerely they are very good. This is evidence to the stability of these programs. We have done well in seeking support from other sources—mostly short-term—other gifts, contributions, sales, and Federal grants—the total of which increased 119 percent.

Finally, I would just like to conclude my comments by saying that we hope that stabilization of Federal funds, followed by moderate increases in uninflated dollars, will permit us to continue our cooperative contribution to agriculture, a food and fiber machine that is the envy of the world. With industry becoming more and more interested in joining into the battle, we think that stabilization will become even more critical.

I thank you.

[The prepared statement of Dr. Lessman follows:]

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TESTIMONY BY KOERT J. LESSMAN BEFORE THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT, THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY, U.S. HOUSE OF REPRESENTATIVES, MAY 13, 1983

JOINT USE OF FEDERALLY SUPPORTED RESEARCH FACILITIES BY INDUSTRIES AND UNIVERSITIES -- THE NEW MEXICO EXPERIENCE

Koert J. Lessman

In 1887, the U.S. Congress spurred research for better agricultural methods by enacting the Hatch Act, providing federal funds for support of the agricultural experiment stations. Two years later, the New Mexico Territorial Legislature established what is now the New Mexico State University and the Agricultural Experiment Station. Over the years, there have been many outstanding cooperative efforts between U.S. Department of Agriculture researchers stationed in New Mexico and the New Mexico agricultural researchers. Four programs will be described.

The Jornada Experimental Range is a federal installation and is adjacent to the New Mexico State University College Ranch. They lie at the southern entrance to the Jornada del Muerto in southern New Mexico. Together, the two research areas cover about 104,000 acres of New Mexico rangeland. The makeup of range vegetation, soil and climate are typical of some 30 million acres of semidesert range in the Southwest, or an area about the size of the state of New York.

According to Fred N. Ares, retired range scientist of the Jornada Experimental Range, cultivated pastures in the Midwest and South may grow enough forage to keep one cow well-fed all summer. However, an average acre on the Jornada will keep her fed for only one or two days.

Since 1927, researchers at the Jornada and the College Ranch have worked together in an effort to find solutions to problems facing southwestern ranchers. Currently, this involves seven Jornada range scientists and a multidisciplinary team of about 17 university research scientists.

Recent cooperative studies have focused on range improvements and

animal management. Range scientists are using mechanical and chemical controls on brush and looking at the long-term impacts of grazing on grasses over the past 50 years. Animal scientists are investigating various aspects of sheep production, beef crossbreeding and the effects of using irradiated sewage sludge as feed. Projects examining diet quality and the feasibility of drylotting cattle for part of each year are being conducted.

The semi-arid ranges have attracted scientists and students from many disciplines and from most world grazing areas. The disciplines include animal and range scientists, botanists, zoologists, soil microbiologists, entomologists, wildlife scientists, soil scientists and geographers. Nearly 400 publications have resulted directly from Jornada and College Ranch research activities, and about 75 theses and dissertations have come from student projects.

Over the years, private industry has recognized the importance of unique research potentials on the Jornada Experimental Range and the College Ranch, and has contributed funds and materials to aid in the research effort.

The Southwest Cotton Ginning Research Laboratory is one of three cotton ginning research laboratories in the United States. It is the only laboratory in the Southwest, and the only one equipped with a roller gin for processing long-staple Pima cotton. As such, the laboratory serves a four-state southwestern area cotton industry with an annual upland cotton production value of $2.8 billion and an annual Pima cotton production value of $54 million.

Researchers at the laboratory have been key support people in several important research break-throughs in cotton production and marketing, including testing of the Acala variety of cotton, which is the foundation

variety for the superior yielding and quality cotton grown throughout the Southwest.

Cotton breeders use the laboratory to test ginning and fiber quality of experimental strains, hybrids and varieties of cotton which will be used in seed increasing programs for newly-released varieties. Controlled conditions available only at a research laboratory assure that purity of seed is maintained during the ginning process.

A unique program at the laboratory concerns investigations of safety factors in gins. One aspect of the program is extensive research to develop methods of reducing operating emissions. It is the only gin in the nation with this major emphasis.

Industry, through such groups as Cotton Incorporated, participates directly in activities at the laboratory by contributing $40,000 worth of people, materials and facilities to solve particularly difficult industry problems. The Agricultural Experiment Station spent $1 in each $10 and one scientist in each seven in a recent year on cotton research to benefit the cotton industry of the Southwest, of which the laboratory is a part.

New Mexico State University is one of the major centers for plant breeding research in the desert Southwest. Existing research in areas of conventional plant breeding, culture tissue techniques and molecular genetics provide a base for a proposed Plant Genetics Laboratory to be staffed by leading federal and university scientists.

The laboratory has a specific charge to address desert adaptations of plants for agricultural production. Interest in the proposed research should be great since much of the world's land area is under arid or semi-arid climates.

Initial plans for the laboratory include a core group of researchers who will have individual and cooperative projects involving basic and

applied genetic research. The current, important economic crop plants produced in New Mexico will receive specific attention. These include vegetables, range plants and field crops. Other plants will be studied for information, and plants with potential for development as new crops under desert production conditions will be evaluated.

The laboratory will interface with an already established tissue culture laboratory, to be discussed later in this report.

It is expected that the Plant Genetics Laboratory will directly bolster and expand the New Mexico agricultural economy and will likely attract investment from the private sector which is already investing more than $1 billion in plant genetic engineering research in the U.S. in universities and private laboratories.

The tissue culture laboratory at New Mexico State University, a research facility staffed by a federal researcher and a university researcher, is a joint venture of federal and state governments and private industry in terms of funding.

The federal and state funds provided for the facility and employment of two scientists, while industry funds provided for equipment.

Although they work with different plants and on different projects, the scientists are able to collaborate in some cellular genetic engineering areas.

For example, both are developing culturing techniques for haploid plant production. If successful, haploid plant production could shorten breeding time in conventional plant improvement programs by as much as 50 percent.

The work these researchers are doing is expected to become an integral part of a proposed Plant Genetics Laboratory, a center of technical excellence in the Rio Grande Corridor.

These efforts as well as a large variety of other activities carried on by the Experiment Station have not been accomplished without cost. Particularly important to the Experiment Station have been the formula fund appropriations of the U.S. Department of Agriculture and state appropriations for the Experiment Station. They are important because their dependability lends stability to the Experiment Station's research program. Most projects are of three to ten years duration. Without dependable formula funds, projects would have to be fragmented to shorter time periods, with more rapid turnover in scientific personnel, unpredictable variations in funding, uncertainty, and unavoidable losses in research efficienty. We are appreciative of this support and believe that it is a major factor in the past successes of agricultural research in the United States.

Unfortunately, the agricultural experiment stations are experiencing a destabilizing trend in funding. Nationally, cooperative agricultural research funding has shown little actual change since 1967 in terms of real dollars. In current dollars it appears that cooperative research has increased more than ten-fold since 1960. However in 1967 dollars, appropriations since 1960 have increased nationwide from about $30 million to about $65 million, or $1.5 million per year. Since 1967, the increase has been about $0.3 million per year, or almost level.

Our Experiment Station has experienced an actual decline in constant dollars of the important federal formula funds allocated to us since the 1976-77 fiscal year. In comparison with other sources of funds, our state appropriations in constant dollars increased 23 percent over a six-year period to the current fiscal year, other grants increased 108 percent, and federal formula funds declined 38 percent. We have done well in seeking support from other sources -- mostly short-term other gifts, contributions, sales and federal grants -- the total of which increased 119 percent.

We hope that stabilization of federal funds, followed by moderate increases in uninflated dollars will permit us to continue our cooperative contribution to agriculture, a food and fiber machine that is the envy of the world.

Mr. SKEEN. Thank you, Dr. Lessman.

Let me interrupt here and give Congressman Durbin a chance to have a say here. He has got to get on down the road, so I just want him to know how much I appreciate his being here today.

Mr. DUBIN. This has been a good hearing, and I'm sorry I can't stay for the close. I do have to leave to make it back to Springfield, Ill., this evening. Unfortunately, I have to leave a little early to do it.

There is one thing that is really disquieting, and that is the fact that we felt in the Midwest that we were losing industry to the Sun Belt—or what some critics call the Rust Belt. To learn today that you are actively seeking through your corridor to attract, really puts the fear of God in us in the Midwest. So I am running back home to redouble our efforts, to make sure we keep what we have and try to attract new industry. But I do appreciate very much all the testimony today.

Joe, you have had a great hearing and I appreciate the opportunity to be here with you and also to get over here and see the university. I thank all of you for participating.

Mr. SKEEN. If you will let us have the excess water that you have, we will leave the industry and the rest of it with you.

The next presentation is by William Dutton.

Mr. DUTTON. Thank you, Congressman Skeen. I am very happy to be here. I am going to spare you all the details of my written documentation, but I would like to add some of the highlights.

The Industrial Revolution came about partly because of the ability of elements when combined to achieve geometic increases in efficiency, and it is interesting to note that in my field of industrial development, and mainly technical development, this same phenomenon is reflected. Innovation, discovery, and high technological companies tend to act like magnets other high-tech companies.

The fundamental importance of technological change and innovation to economic growth and prosperity is widely acknowledged by economists and other observers of economic development. Unfortunately, overall efforts in research and development in the United States—in both the public and private sectors—have not kept pace with the innovation taking place in foreign countries, especially Japan and Germany.

As a result, the products of many American industries are no longer competitive in world markets. It's interesting to note that the Japanese industrial success is widely attributed to government, university, and private industry cooperating in the field of research and development, leading to new products.

Utilization of new technology and innovation in industry and the development of future oriented industries is of special importance to New Mexico because of our State's current heavy reliance on extractive industry and agriculture. These industries, by their very nature, are cyclical, making New Mexico vulnerable to national recessions, as our current high rate of unemployment will attest.

I believe the answer to some of these problems are three famous centers of high technology in this country, so famous that even the newspapers and economic developers are aware of them. That's Route 128, Boston, the Silicone Valley, and the Research Triangle Park.

I believe the Rio Grande Research Corridor most closely tracks the Research Triangle Park, and it may be helpful to have some background on this, what is probably the most successful venture of its kind in the country. Until the late fifties, North Carolina economy had been dominated by agriculture and a few low-paying, low-technology industries, such as tourism, textiles, tobacco, furniture, and bricks.

At that time, the then Gov. Luther Hodges and a few State leaders from the business and financial community began to take steps to alter this picture, and the development of two closely linked institutions—the Research Triangle Institute and the Research Triangle Park—was the result of these efforts.

Research Triangle Institute is a nonprofit research institute which performs contract research for various State and Federal governmental departments, private industry, industrial and trade associations, and other organizations such as the National Science Foundation. It was patterned after the previous successful models of the Stanford Research Institute and Battelle Memorial Institute.

Research Triangle Institute was incorporated in late 1958 and is a joint affiliate of three universities—Duke University, the University of North Carolina, and North Carolina State University. These schools saw that the whole of benefits derived by combining their research resources into one entity would be greater than the sum of their individual parts, and they began the following spring with a small staff in rented space.

In fact, in 1960 they had contract revenues of $280,000 and 54 employees. By 1978 they had revenues of $30 million and over 1,000 employees.

Incidentally, the dominant source of these revenues is the Federal Government, either directly from Federal departments and agencies or from funds granted to local and State governments, with the balance coming in about equal portions from industry and the State of North Carolina.

In the early years, contributions from private sources and contract revenue were insufficient for their operations, and the State granted subsidies in the form of grants from the State of North Carolina and the Research Triangle Foundation, which was the developer and operator of Research Triangle Park, where required. However, since its third year, it has been self-sustaining.

Research Triangle Institute, or RTI, conducts research basically for several major groups, and they are social sciences, statistical sciences, engineering, chemistry and life sciences, and environmental sciences.

One of the unique features of the institute is this joint ownership by and working relationship between the three universities previously mentioned. Representatives from the universities sit on the board and many senior staff members of RTI hold professorships and teaching appointments at the university. Mutual effort to support the universities and the institute is viewed as the most productive feature of the success of this institute.

Over its 20-year life, the institute has provided extensive service to North Carolina government and industry in such fields as statistical analyses, sample surveys, environmental impact studies, air and water quality studies, energy management planning, and tech-

nical assistance to industry. They are also emphasizing such areas as regional planning, economic analysis and forecasting, and resource development for the State government.

Meanwhile, Research Triangle Park has enjoyed a parallel pattern of growth and success. The 5,000-acre park is located in the middle of a triangle formed by the cities of Durham, Chapel Hill, and Raleigh. The site was selected because of its easy accessibility to the three universities located within these cities and because it was on hard, level land which was unsuitable for agriculture.

Like the Research Triangle Institute, Research Triangle Park was the development of the late Gov. Luther Hodges and other civic-minded leading citizens of North Carolina. The park is operated by a nonprofit organization, but is self-supporting and derives its income from the sale and lease of parkland to research organizations which then build laboratories and other facilities on the sites.

In some cases, company headquarters have been built in conjunction with the research facilities. Being a nonprofit organization, the foundation returns its so-called profits from the sale and lease of properties to the three universities in the form of scholarships.

The park has gained occcupants at the rate of about one per year when the project received a major boost with the addition of IBM and the National Institute for Environmental Health Sciences in 1965. The arrival of IBM, which is the park's largest employer with 3,500 employees, is regarded as the cornerstone of the park's success.

The park is approximately one-third occupied and has 30 occupants representing both private industry and the Federal Government, as well as the extensive facilities occupied by Research Triangle Institute.

The park employs approximately 14,000 people with a combined payroll of $245 million annually. And about 1,000 employees are being added annually and they believe that they will reach an employment level of 30,000 when the park is fully occupied.

Three reasons are generally cited for the success of Research Triangle Park. First, its accessibility and cooperative attitude of the triangle universities, which allows a free and open interaction between the schools and the companies and agencies. Second, North Carolina has a wide variety of cultural and recreational resources and a mild and pleasant climate which permits their year-round enjoyment.

Finally, they took great care to create and maintain a pleasant rural, campuslike atmosphere.

Research Triangle Park is the largest and probably the best known facility of its kind in the United States and can be considered a success by almost any standard. In my opinion, however, because New Mexico has all these aspects, there is no reason why the Rio Grande Research Corridor as a similar program will not work in New Mexico.

Dr. Daw referred to the Thursday article in the Wall Street Journal. I would not like to read it, but in essence it says that a company called Microelectronics & Computer Technology Corp. is looking for a new site, and there are four finalists—Atlanta, San Diego, Boston, and Austin or Research Triangle Park—and why are over

16,000 economic development agencies going after this is because they are going to spend as much as $100 million a year and employ some 400 engineers and computer scientists.

Hitting the highlights of the article, they basically point out that what the company is looking for is, first of all, a pleasant place to be and a reasonable place to do business, but more importantly, its access to first-class universities and the pool of talent that they graduate, as well as the research and development facilities that they have been offered by working with industry.

Mr. SKEEN. Could you submit that for the record, and let's have it entered in the record in its entirety?

Mr. DUTTON. Certainly.

[The prepared statement of Mr. Dutton follows:]

STATEMENT FOR THE HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY BY WILLIAM A. DUTTON, EXECUTIVE DIRECTOR, GREATER LAS CRUCES INDUSTRIAL DEVELOPMENT BOARD, MAY 13, 1983

BACKGROUND

WILLIAM A. DUTTON

1972 - 1974:	Manager of Industrial Development, Greater Cleveland Growth Association.
1974 - 1976:	Executive Director, Ohio Development Financing Commission.
1976 - 1980:	Underwriter of Industrial Revenue Bonds, The Onio Company.
1980 - 1982:	Consultant, Ohio Department of Economic Development.
1982 - Present:	Executive Director, Greater Las Cruces Industrial Development Board.

STATEMENT FOR THE HOUSE COMMITTEE

ON SCIENCE & TECHNOLOGY

The ability of various elements in the periodic table to achieve geometric increases in efficiency by combining with heat and/or pressure, is reflected in the entire phenomenon of technological development. Invention and discovery breeds new invention and discovery. Innovation, in no small way, has enabled the country to enjoy the health and prosperity we enjoy today.

Perhaps the automobile is the best example of the dynamics of innovation and technological development. This invention, which provides us with unprecedented mobility and convenience, would still be a rich man's joy without the simultaneous development in such diverse fields as civil and mechanical engineering, metallurgy, the invention of the pneumatic tire, the assembly line, and numerous other innovations.

The fundamental importance of technological change and innovation to economic growth and prosperity is widely acknowledged by economists and other observers of economic development. Unfortunately, overall efforts in research and development in the United States, in both the public and private sectors, have not kept pace with the innovation taking place in foreign countries, especially Japan and Germany. As a result, the products of many American industries are no longer competitive in world markets.

The utilization of new technology and innovation in industry, and the development of future oriented industries is of special importance to New Mexico, because of the State's heavy reliance on extractive industry and agriculture. These industries, by their very nature, are cyclical, making New Mexico vulnerable to national recessions -- as our current high rate of unemployment will attest.

It was to answer these problems that the concept of the Rio Grande Research Corridor was developed.

Patterned after Research Triangle Park, it is our belief that the federal laboratories, the universities, and private industry can inneract to create the future-oriented industries that New Mexico's future prosperity will depend upon.

Some background on what is probably the most successful venture of this kind (Research Triangle) may be instructive.

Until the late 1950's, North Carolina's economy had been dominated by agriculture and a few low-paying, low-technology industries, such as tourism, textiles, tobacco, furniture, and bricks. At that time, the then Governor Luther Hodges and a few state leaders from the business and financial community began to take steps to alter this picture. The development of two closely linked institutions, Research Triangle Institute, and Research Triangle Park, was the result of these efforts.

Research Triangle Institute (RTI) is a non-profit research institute which performs contract research for various state and federal governmental departments, private industry, industrial and trade associations, and other organizations such as the National Science Foundation. RTI was patterned after the previously successful models of the Stanford Research Institute and Battelle Memorial Institute.

RTI was incorporated in late 1958. It is a joint affiliate of three universities -- Duke University, The University of North Carolina, and North Carolina State University. These schools saw that the "whole" of benefits derived by combining their research resources into one entity would be greater than the "sum"

of their individual parts. RTI began operations the following spring with a small staff in rented space.

RTI has enjoyed considerable success and growth and success in the ensuing twenty years. It is now housed in twelve buildings on 180 acres in the Research Triangle Park and employs a staff of approximately 1,000 people.

The following table highlights the growth of RTI up to 1978.*

Year	Contract Revenues	Employees
1960	$ 280,000	54
1965	$ 3,600,000	263
1970	$ 7,500,000	384
1975	$16,200,000	650
1976	$17,500,000	734
1977	$26,000,000	830
1978	$30,000,000	1,000

The dominant source of these revenues is the Federal Government, either directly from federal departments and agencies or from funds granted to local and state governments, with the balance coming in about equal portions from industry and the State of North Carolina.

In its early years, contributions from private sources and contract revenue proved insufficient to sustain RTI operations, and subsidies in the form of grants from the State of North Carolina and the Research Triangle Foundation (the developer and operator of Research Triangle Park) were required. However,

*Source: RTI 20th Year of Operations Report.

since 1962, its third year of operation, RTI has been self-supporting.

RTI has continued to enjoy support from state government, however, in the form of both grants to purchase equipment and in contracts to conduct research for various state departments and agencies.

Although equipped and staffed to conduct research in a wide range of scientific, engineering and social fields, three-quarters of RTI's research is in areas concerned with health, education, energy, environmental, economic, and other societal problems.

RTI research efforts are conducted by four multidisciplinary groups: Social sciences; statistical sciences; chemistry and life sciences; and energy, engineering, and environmental sciences. A partial sample enumeration of RTI's research activities is as follows:

1. Social Sciences

   Assessments of educational progress
   Health care planning and education
   Population growth and distribution
   Drug and alcohol abuse
   Crime and delinquency
   Consumer behavior

2. Statistical Sciences

   Computer applications
   Sampling research and design
   Statistical methodology and analysis
   Survey operations

3. Chemistry and Life Sciences

   Reproduction and fertility
   Drug delivery systems
   Drug abuse
   Cancer chemotherapy
   Water desalination
   Toxicology

4. Energy, Engineering, and Environmental Sciences

Solar cells
Energy conservation
Radiation tolerance
Satellite oceanography
Occupational hazards
Civil defense

The foregoing, a very small sampling, still gives an indication of the broad capability and interests developed by RTI and its staff.

One of the unique features of Research Triangle Institute is its joint ownership by, and working relationship with Duke University, the University of North Carolina, and North Carolina State University.

Representatives from the universities sit on the RTI Board of Governors, and many senior staff members of RTI hold adjunct professorships or teaching appointments at the universities.

In some joint research projects, part of the work may be performed by RTI and part at a university. In other cases, university professors and scientists act as consultants to RTI staff.

This mutual effort and support is viewed as most productive in the opinion of both parties.

Over its twenty-year life, RTI has provided extensive service to North Carolina government and industry, including statistical analyses, sample surveys, environmental impact studies, air and water quality studies, energy management planning, and technical assistance to industry.

RTI has placed special emphasis on such areas as regional planning, economic analysis and forecasting, and resource development in its research projects conducted for state government.

Other research includes the construction of a state econometric model and devising state development strategies.

The establishment of Institute policy and overall managerial control rests with RTI's Board of Governors. This 27 member board consists of thirteen representatives from the universities, thirteen members from the business and professional communities of the state, and the president of Research Triangle Institute.

Meanwhile, Research Triangle Park has enjoyed a parallel pattern of growth and success. The 5,000 plus acre park is located in the middle of a "triangle" formed by the cities of Durham, Chapel Hill, and Raleigh. The site was selected because of its easy accessibility to the three universities located within these cities, and because the land was "hardscrabble" woodland unsuitable for agriculture.

Like the Research Triangle Institute, Research Triangle Park was the creation of the late Governor Luther Hodges and other civic minded leading citizens of North Carolina. The park is operated by a non-profit organization, the Research Triangle Foundation. The Foundation is self-supporting and derives its income from the sale or lease of park land to research organizations which then build laboratories and other facilities on the sites. In some cases, company headquarters have been built in conjunction with the research facilities. Being a non-profit organization, the Foundation returns its "profits" from the sale and lease of properties to the three universities in the form of scholarships.

In December of 1958, the Foundation was formed to take over the assets and operations of the park from the private group which had originally raised the funds to purchase options on the property. The first 4,000 acres were acquired for less than $300 per acre. Now, land prices in the park are around $15,000

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per acre.

The Foundation donated land to Research Triangle Institute, and in 1959 the Institute and Chemstrand Research Center (now Monsanto Triangle Park Development Center) became the park's first occupants.

The park gained occupants at the rate of about one per year when the project received a major boost with the addition of IBM and The National Institute for Environmental Health Sciences in 1965. The arrival of IBM, which is the park's largest employer with 3,500 employees, is regarded as the cornerstone of the park's success.

The park is approximately one-third occupied and has 30 occupants representing both private industry and the Federal government, as well as the extensive facilities occupied by Research Triangle Institute. Among the private corporations are: IBM, Troxler Laboratories, Burroughs-Wellcome, TRW, Union Carbide, Mead Technology Laboratories, and Northern Telecome. The Federal Government is represented by agencies such as the National Institute for Environmental Health Sciences, the EPA, the National Center for Health Statistics, the Army Research Office, and the U. S. Forestry Service.

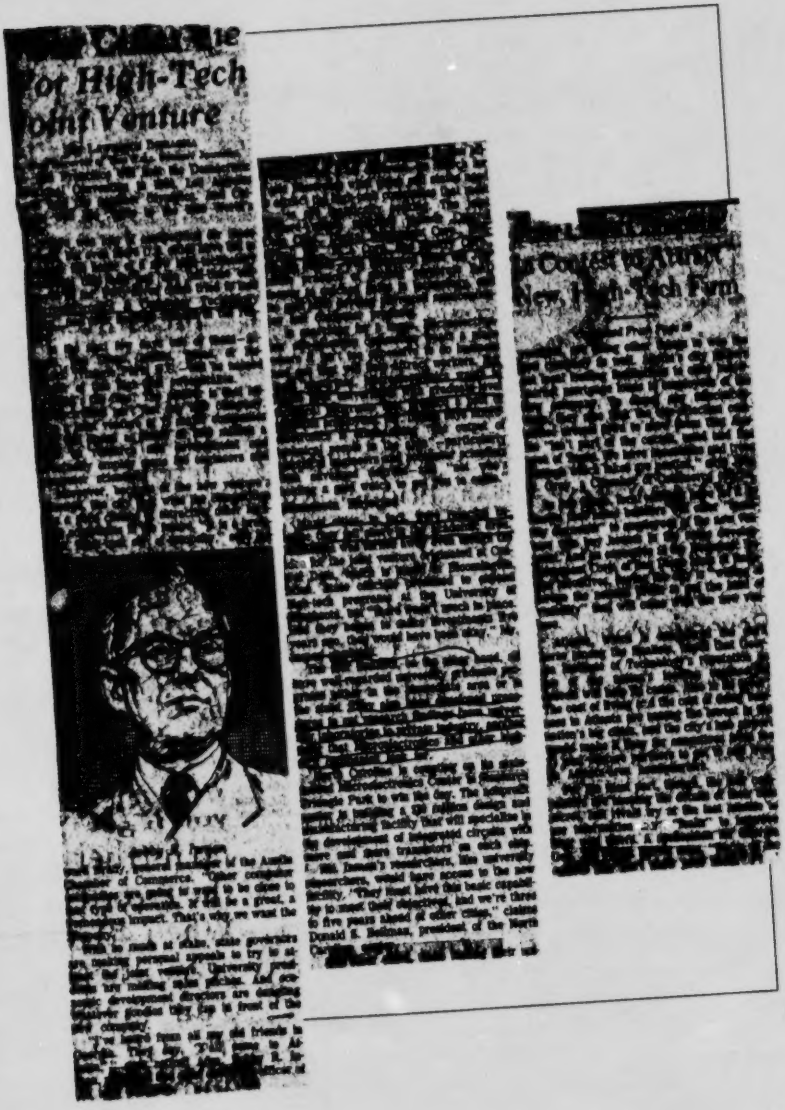
The park employs approximately 14,000 people with a combined payroll of $245 million annually. Around 1,000 employees are being added annually, and the Foundation believes that total employment will reach 30,000 when the park is fully occupied.

Three reasons are generally cited for the success of Research Triangle Park. First is the accessibility and cooperative attitude of the triangle universities, which allows a free and open interaction between the schools and the companies

and agencies. Secondly, North Carolina has a wide variety of cultural and recreational resources, and a mild and pleasant climate which permits their year round enjoyment. Finally, the Foundation has taken great care to create and maintain the park's pleasant rural campus-like atmosphere.

Occupants of the park are permitted to build on only 15% of the land they own or lease. This provides plenty of green space between facilities. Only a minimal amount of manufacturing is allowed in the park. IBM is permitted to assemble and test terminals, but most manufacturing is restricted to a peripheral area outside the park.

Research Triangle Park is the largest and probably the best known facility of its kind in the United States and can be considered a success by almost any standard.



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oint Venture

Mr. SKEEN. I would like to ask the staff if they have any questions that they would like to ask of this panel at this time.

Mr. NICHOLAS. Dr. Daw, there is a point in your statement toward the end where you mention or discuss the hazardous waste problem at the university, how to dispose of chemicals that are used at the university for research purposes, I gather. Hazardous waste has been a problem that has taken a great deal of attention in Congress because of the examples over the years of problems of hazardous waste that we're all quite familiar with.

And I wasn't quite clear from your testimony how you think this problem might better be handled, given the potential problem that exists when hazardous wastes are not properly disposed of and given the lack of knowledge about, generally, the effects of hazardous wastes.

Dr. DAW. I am not opposed to proper care of hazardous wastes. NMSU, I understand, will be the first institution in the country to have part B go to public hearing. So in terms of what others have done, we have moved a long ways ahead. I think that one of the problems that we experienced in this area was that the regulations were put in without the necessary infrastructure to carry it out, that is, there were not transportation companies to haul it; there were not adequate sites to receive and take care of it. But the regulations were imposed ahead of that. New Mexico State University, with its modest amount of chemicals, was cited by the ERPA for failing to comply with the regulations in eight areas.

We disagree with those. But they, in fact, proposed to levy fines of $25,000 per count on the eight counts per day. Multiply that out, and in the time that it has taken us to settle that matter with the EPA, it would have taken our entire university budget to solve them.

Furthermore, the regulations, I think, are not written—they are written in a sense with large industries in mind, which have large quantities of chemicals, sort of a single waste strain, that is, this company produces that hazardous waste.

Universities produce literally hundreds of hazardous waste—an ounce of this, a bottle of that—and they each have to be accounted for separately. And it really makes it a very difficult sort of thing. The reason that I brought that one up is because it drives the indirect costs up. Those things fit into the indirect costs.

We can do them and we have been doing that and filling out the form and doing the shipping, but when this one says, "How come your indirect cost is rising? We want to hold them down," our reply is that they go up because of the regulations which are weighed on us. I trust that answers your question.

Mr. SKEEN. I want to say that it's been very illuminating, and I gather, from the sense of what this panel talked about, it sort of puts a downside somewhat to the ebullience that we had from an earlier panel group that everything was nice and rosy, if you have the kind of cooperation and the combined use of laboratory facilities between the laboratory itself, the universities, and the private sector. And I appreciate that very much.

You know, in 1980 we tried to enact changes in the patent law to provide a smoother transition of technology transfer. And, Mr. Snyder, I think that you mentioned that, along with the use of the

word "implicit technology transfer." What more can we do as far as government is concerned? We're always hesitant—or I am hesitant—to wade into an area where the approach in Government has either been overregulated, overfocused on what the Government can do, and how they should be making the decision, or overfunded or underfunded, depending on what the cause may be.

I appreciate Dr. Daw and Dr. Lessman talking about, "we never have enough funding." If you had said that you had enough funding, I would have fainted dead away.

Mr. Snyder, would you expand on that just a little bit?

Mr. SNYDER. Yes. I think I want to emphasize two points. The first point is this coupling between accountability and authority. What has happened with the increased central federalization of R&D is the retention at the Washington level in the authority for the directing of the research and, nonetheless, holding the universities and even the national laboratories accountable for the credit.

Any experienced manager realizes that when you separate authority and accountability, it is an unnegotiable situation, particularly when the authority—that is, the individual—that are holding the authority are gaged against a criteria performance which is not one and the same of the criteria performance of those who are being held accountable.

That, in my judgment, is a fundamental problem in Federal research direction, particularly in the sort of contrary sciences, the modern sciences, in which high technology industry development is depending. The universities see it and they complain about it. The industries that contract to do work for the Government see it and complain about it. We in the national laboratories see it and complain about it and it does not change.

The second point I want to dwell on is that having spent 30 years in a national laboratory, I, quite frankly, am appalled, in spite of the legislation and in spite of the intensity of the Federal level, of the ability to move technology out of the laboratory—national laboratories, Federal laboratories—into the private sector in a manner in which products can be made that are competitive nationally and internationally.

There are just a host of impediments with the universities contracting. They are the sole source of problems. In the context of patents we have attempted to deal with that. In the context of a grossly overabused word called conflict of interest, which has taken to an exaggerated length, we have problems getting technology into the hands of the private sector.

In New Mexico recently, there was a model that I think ought to be examined very closely. We can set the stage for a whole revolution in this area, in my opinion. The model was the transfer of the technology for the insulin pump to the private sector. The participants of that were Sandia National Laboratory, the University of New Mexico, and the private firm that is going to package and produce and market the insulin pump.

It is a model agreement where there is mutual benefit for all, each retaining its own desired role, its historical role, and a role in which it functions best.

But there is a ruination in terms of research funds in front of us. It is a model that ought to be studied very carefully and even

charged one to perceive. It corrects a two-decade problem we have in this country, in my opinion, in which industry and government are perceived as totally different states.

It's difficult to move back and forth across that interface because if you have ever tried to transfer technology, if you have an idea, if you have a research product, it takes a year to two years of legal machinations, of having endless numbers of briefings for every single individual who might have even the slightest interest of making apathy from it. It's an incredibly tortuous path to move ideas from the Federal laboratory into the private sector.

As long as we move in that direction in this country, we are going to have a terrible time competing with what is called Japan Inc., in which industry, government, and universities work jointly in the same laboratory and the same idea and with only modest attention to who makes the profit because the profit ultimately comes back as revenue into the tax dollars which support the universities, etc.

I think we have come in a terribly degrading direction in this country with our science and technology policy and with our exaggerated emphasis of conflict.

Mr. SKEEN. Mr. Snyder, could we have from you, or could you make it available to us for our record, a copy of that insulin agreement, if there is any background information you might have?

Mr. SNYDER. I will have the people at the University of New Mexico, Sandia, and the private firm, I will give you examples of those agreements in anticipation. I think it is a real model. I think we need to go much further in that direction.

Mr. SKEEN. Dr. Lessman, I notice on your chart that there is a drop of some 30 percent in Federal funding for the agriculture experimental station?

Dr. LESSMAN. Yes, sir. That is in adjusted dollars.

Mr. SKEEN. I want to thank Dr. Gray over there for his great assistance.

Have you had to consciously take a lot of time and effort to seek grants from other sources and so forth? Is that part of your program?

Dr. LESSMAN. Yes, that is what is being shown up there as our increase in other social funding. In nonadjusted dollars since 1978, that increase has been 600 percent.

Mr. SKEEN. So it has been a conscious effort on your part?

Dr. LESSMAN. On our scientists.

Mr. SKEEN. When they could be working on other projects and so forth, but they have had to get into fundraising?

Dr. LESSMAN. You are right on it. Too much energy.

Mr. SKEEN. I just wanted to make sure we didn't miss the point. I want to thank you all very much. And I'm sorry about the time restraints, but I do appreciate it and all the testimony.

Again, if any questions come up, we would like to submit them in writing if we may. You have made great contributions, and I appreciate it very much and so does the rest of the staff and committee.

Thank you.

We have Ms. Claire S. Newcomer, who is from the Office of the Assistant Secretary for Land and Water Resources, U.S. Depart-

ment of the Interior; Dr. George O'Connor, who is acting director of the New Mexico Water Resources Research Institute, NMSU; and James Whitford, who is city manager of Roswell, N. Mex. Ms. Newcomer, would you go ahead and give your testimony?

STATEMENTS OF CLAIRE NEWCOMER, OFFICE OF THE ASSISTANT SECRETARY FOR LAND AND WATER RESOURCES, DEPARTMENT OF INTERIOR, WASHINGTON, D.C.; DR. GEORGE O'CONNOR, ACTING DIRECTOR, NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE, NEW MEXICO STATE UNIVERSITY, LAS CRUCES, N. MEX.; AND JAMES WHITFORD, CITY MANAGER, ROSWELL, N. MEX.

Ms. NEWCOMER. Thank you, Mr. Chairman. I appreciate the opportunity to be here today. I know that Garrey Carruthers, Assistant Secretary for Land and Water Resources, my boss, is a good friend of yours. Unfortunately, he had another hearing commitment in Washington, which gives me an opportunity to visit Las Cruces, a place I have heard often about from several different New Mexicans I have the pleasure of working with.

Let me just briefly summarize my statement. This administration's policy is to form new partnerships whereby Federal and non-Federal entities share responsibilities for water resources research and information gathering. States have the primary authority and responsibility for water resources management, and we look to them to play a lead role in developing the information upon which to base water management decisions.

However, this does not mean that the Federal Government should abandon its investment in water research, but rather, focus funding to those areas that are clearly in the national interest.

Early in this administration, we saw the need to carefully review the water research programs of the department for the purpose of identifying ways to encourage new partnerships in joint research undertakings. We questioned the need for a continued Federal role in this line of research and development since the private sector has already moved into commercialization of the technology and would themselves be the principal benefactors of further research.

Therefore, we moved to adopt the policy of negotiating the transfer of our two experimental desalting test facilities to the non-Federal sector. The goal of encouraging and providing for joint ventures such as these cannct be achieved by maintaining the status quo.

For example, research funding for the water resources research institute program is restricted to university participants. Industry is precluded from participating. In the Bureau of Reclamation's nationally competitive grant program for water research, it's unusual to have joint industry/academic projects proposed for funding.

However, there are some good examples. For example, here in New Mexico where we do have strong university/State ties, the State of New Mexico provides significant water research funds to universities through the New Mexico Water Resources Research Institute. We are really pleased, also, to note that the State legislature has taken steps to fund saline water research by the New

Mexico Water Resources Research Institute, to be conducted in association with the Roswell Test Facility.

Now I would like to just briefly focus on our efforts to turn over the Roswell Test Facility's operation. In June of last year, we published a notice in the Commerce Business Daily seeking expressions of interest in operating the facilities.

Of course, Roswell submitted a response to our announcement. Shortly thereafter, we began to negotiate with them on takeover. On January 12—earlier this year—Garrey Carruthers came to Roswell and signed a use agreement which transferred operation and maintenance responsibility for the test facility to the city.

The city is required to operate the facility predominantly for water resources research and maintain the property without any continued financial support from our department. They assumed full responsibility—and Mr. Whitford, I am sure, can bring you up to date on their negotiations. I should also just note briefly that we signed a similar agreement in January with Wrightsville Beach of North Carolina, and they took over the facility April 1.

Just in conclusion, I think we strongly support joint water resources research partnerships. We have long held that those closest to water problems of this country are in the best position to develop appropriate solutions to these problems, given the unique nature of each State. Joint Ventures such as are developing here in New Mexico and at Wrightsville Beach join researchers and the users of research results into the kind of partnership where each benefit. We get solutions developed, research has more immediate applicability since the beneficiaries are brought closer to the research process, the municipality is operating and maintaining the facilities at no cost to the government and the country has strengthened its technical capability.

[The prepared statement of Ms. Newcomer follows:]

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Statement of Claire S. Newcomer, Staff Assistant to the Assistant
Secretary for Land and Water Resources
U.S. Department of the Interior
Before the House Committee on Science and Technology,
Subcommittee on Investigations and Oversight
Las Cruces, New Mexico
May 13, 1983

Mr. Chairman:

Thank you for the opportunity to appear before you today to examine the joint use of federally-supported research facilities by industry and universities with the goal of reducing the cost to taxpayers and enhancing technology transfer. Unfortunately, Assistant Secretary Garrey Carruthers was not able to be with you today because he is testifying at a Congressional hearing in Washington. I know he would prefer to be here in Las Cruces, but it gives me the opportunity to visit his home base--a place he brags about endlessly.

This Administration's policy is to form new partnerships whereby Federal and non-Federal entities share responsibilities for water resources research and information gathering. States have the primary authority and responsibility for water resources management and we look to them to play a lead role in developing the information upon which to base water management decisions. This does not mean that the Federal Government should abandon its investment in water research but rather, focus funding to those areas that are clearly in the National interest.

In the area of water research, Federal funds were used over the past 20 years to stimulate research among States, usually working through State universities and industry to solve common problems. Both State governments and industry have benefitted from the extensive and useful information that was generated. The

time has come, however, for the non-Federal sector to assume greater responsibility for financing research of direct benefit and interest to them.

Early in this Administration, we saw the need to carefully review the water research programs of the Department for the purpose of identifying ways to encourage new partnerships in joint research undertakings. We discovered, for example, that the Federal research and development investment in desalting had sufficiently advanced this technology to the point where it was already commercially available on a broad scale and being utilized not only in the United States but around the world. We questioned the need for a continued Federal role in this line of research and development since the private sector had already moved into commercialization of the technology and would themselves be the principal benefactors of further research. We thus adopted the policy of negotiating the transfer of our two experimental desalting facilities to the non-Federal sector. We saw in both cases an opportunity to expand desalting research into areas such as utilization of brackish waters in plant production and for industrial purposes if corrosion problems could be resolved.

The Department shares the concern of the Committee that this Nation must build stronger partnerships between government, industry and the academic community. Of roughly $60 million spent annually by the Department on water related research, approximately $6 million is directly available to universities through the Water Resources Research Institute program administered by the Office of Water Policy. Another $4-5 million is available on a competitive basis to any qualified individual or organization through the Bureau of Reclamation for National water research

and development in the areas of water reuse, water conservation and use efficiency, brackish water utilization, groundwater management, and saline water conversion. Under current authority, we have little flexibility to administratively build into these two programs incentives to foster joint partnerships between government, industry, and academia.

Consistent with our policy of State primacy in water management, we believe that our research policy should be directed at the following goals: (1) enhance the capability of the States to manage water, (2) encourage State, local and private investment in water related research, and (3) build a collective National technical capability to solve water problems of the future.

The second goal, the focus of these hearings, cannot be achieved by maintaining the status quo. For example, research funding for the Institute program is restricted to University participants. Industry is precluded from participating. In the nationally competitive program administered by the Bureau of Reclamation, it is unusual to have joint industry/academic projects proposed for funding. There have been, however, notable instances of strong University/State ties, a good example is here in New Mexico. The State of New Mexico provides significant water research funds to universities through the New Mexico Water Resources Research Institute. This arrangement probably grew out of a recognition by the State to address its own critical water scarcity problems rather than being prompted by Federal incentives. We are also pleased to note that the legislature of the State of New Mexico has already taken positive steps to fund saline water research by the New Mexico Water Resources Research Institute, to be conducted in association with

the Roswell Test Facility. The Administration applauds this effort by the State to assume its rightful control over the water research program.

I would now like to focus on our efforts to turn over operation of the Roswell Desalination Test Facility to the City of Roswell, New Mexico. City Manager Jim Whitford will be able to bring the committee up-to-date on their efforts to secure research contractors at the site.

Let me outline the sequence of events that led to transfer of the two research facilities:

1. The Department, pursuant to the conference report accompanying the Fiscal Year 1982 Interior and Related Agencies Appropriations Act, Public Law 97-100, submitted to Congress on February 16, 1982, a comprehensive transition plan for the saline water program and two desalination test facilities, located in Wrightsville Beach, North Carolina (WBTF), and Roswell, New Mexico (RTF). The Appropriations Committees agreed that industry should begin to assume the program for research and development in water reuse and desalination. Two options were cited in the conference report: (1) facilitate further use of the facilities for their intended purpose or, (2) dismantle them so the property could be put to other beneficial use. The report to Congress recommended that the Department solicit proposals from industry, industry-university, non-profit organizations and from any other qualified entity to operate the RTF and WBTF. Highest priority would be given for continuation of some or all of the intended purposes of the facilities with the second priority making the properties available

to State and local government for other beneficial uses.

2. A notice was published in the Commerce Business Daily on June 28, 1982, seeking expressions of interest in operating the facilities.

3. The City of Roswell, with the support of Chaves County, New Mexico, the town of Wrightsville Beach, and the LaQue Center for Corrosion Technology, Inc., submitted responses to the announcement. The Department judged the City of Roswell to be the best qualified entity to assume responsibility for the RTF and the town of Wrightsville Beach, with the LaQue Center as research partner and subcontractor, to operate the WBTF. Shortly thereafter, the Department commenced negotiations with both municipalities.

4. On January 12, 1983, Assistant Secretary Garrey Carruthers signed a use agreement in Roswell transferring operation and maintenance responsibility for the RTF to the City. The agreement expires December 31, 1983. The City is required to operate the facility predominantly for water resources research and maintain the property without any continued financial support from the Department. The City assumed full responsibility for facility operations on March 1, 1983, after a brief transition period. The City negotiates directly with private industry to conduct research at the site.

5. On January 25, 1983, an agreement was reached with the town of Wrightsville Beach with the town assuming a similar responsibility

for the WBTF. Under this agreement, the town may also lease unused office and warehouse space for other public functions provided such use does not interfere with operation of the plant as a research facility. The agreement with the town was based on having the town enter into a subcontract with the LaQue Center for Corrosion Technology, a division of the International Nickel Company. LaQue would provide qualified technical personnel to oversee research and development activities. The LaQue Center notified the town on March 15, 1983, that they did not wish to continue this effort. The agreement allows the town 60-days to find a successor subcontractor.

In conclusion, we strongly support joint water resources research partnerships between State and local governments, industry and the academic community. We have long held that those closest to water problems of this country are in the best position to develop appropriate solutions to these problems given the unique nature of each State. Ventures such as are developing here in New Mexico and at Wrightsville Beach join researchers and the users of research results into the kind of partnership where each benefit. Appropriate solutions are developed, the research has immediate applicability, and the country is strengthened in its technical capability. We applaud these efforts.

Thank you for the opportunity to testify.

Mr. SKEEN. Thank you very much.

Dr. O'Connor.

Dr. O'CONNOR. Thank you, Mr. Skeen.

Mr. Chairman, I am the acting director of the New Mexico Water Resources Research Institute, and I am here today to address the issue of joint utilization of funding, of people, and of facilities and how this cooperation relates to water research. I will begin with a short description of the institute's mission and its role in administering water resources research.

I would like to have the first slide, please.

[Slide.]

The institute's mission is threefold. Its primary goal is to encourage and sponsor water resources research. The institute's aim also is to make water research information available through several technology transfer mediums such as conferences and publications. No less important is the institute's role in encouraging the training of water scientists.

Historically, the bulk of our funding has come from Federal sources. However, as the Federal investment in water research has diminished, the institute has been able to attract increased support from State and private sources. It is not uncommon for each of these sectors to cooperatively fund a single research project. Several institute projects have received support from Federal agencies such as the National Science Foundation, the Bureau of Reclamation, and the Environmental Protection Agency.

In addition to the State's annual allotment program, funding also has come from State-supported agencies, including the Interstate Stream Commission, the New Mexico Department of Game and Fish, and the New Mexico Department of Forestry. Private agencies such as the High Plains Associates, Synfuel Convertor, and Ionics, Inc. also have made considerable investment in our water research program.

A prime example of funding cooperation involving desalting demonstrations illustrates the benefits of both cooperative funding and technology transfer. Supported by the WRRI, the Office of Water Research and Technology, the New Mexico Interstate Stream Commission, and Ionics, Inc., researchers built a mobile desalting van to demonstrate onsite reverse osmosis and electrodialysis techniques in desalting water for public supply.

Because the van was taken into the communities, residents could judge for themselves how well the techniques worked in solving their particular water problems. The communities also were given an idea of how much the desalting would cost.

The institute, for all its ambitions, is not one of the big spenders in research. We rarely allot more than $25,000 per year for one project. This money often matches or supplements funding from other sources. We encourage researchers to use this as seed money to attract other project sponsors.

A WRRI salt grass research project, for example, started as a small 1-year project funded through the institute—about $13,000, I think. Then, because the preliminary results proved promising, the project received a Federal/State cooperative matching grant for greenhouse testing. Because those tests showed that salt grass has high productivity under the light and salinity conditions expected

in the field, the project has received long-term support for field research.

Another research project that could follow the same trend is one dealing with the onsite analysis of metals in water. The institute funded the initial research and is now asking for Federal cooperation for further development. And because the project has direct application for industry, we hope industry will support the final stage, implementing the technique in plant design.

Water resources research is also a valuable training ground for young scientists. The link between the educational system and industry is crucial to future scientific and industrial productivity. For this reason, student employment is encouraged in every institute research project.

In the past 10 years, an average of 90 students a year have worked on institute-sponsored research projects.

The educational process of preparing students for careers in science and technology enhances the effectiveness of the Federal research dollar.

Another facet of the institute's research program is water resources information. The Annual New Mexico Water Conference is our most public outlet for water resources information. For 28 years, the institute—on the recommendation of its advisory committee—has chosen a specific New Mexico water problem as the conference theme.

This year the institute cooperated with the New Mexico Environmental Improvement Division and the U.S. Geological Survey in presenting a day-and-a-half conference on water quality, and you can tell by the turnout, it was a popular topic.

The institute has no in-house research staff. Instead, we draw from a statewide pool of scientific talent and facilities at the State's universities. Through this cooperation, the institute makes the maximum use of the taxpayers' education and research dollar. An example of an institute-sponsored project which has a high-value return for very little investment is a water harvesting project at New Mexico State University's plains branch agricultural experiment station.

In this case, the institute is sponsoring research vital to our mission in an area where research results are highly visible to the agricultural community. We can reap these benefits in part because we are using the existing facilities and the researcher supported by Federal and State funds.

An example of joint use of Federal facilities for water research has involved cooperation with the U.S. Department of Agriculture's Jornada Experimental Range near Las Cruces. This research is involved in the description of the movement of various solutes, including hazardous wastes, through soils in a semi-arid environment.

Most recently the institute was successful in being named by the State Legislature to administer a $500,000 research project involving the direct use of saline water. The institute will cooperate with private industry and the City of Roswell on this multidisciplinary 2-year project involving the Roswell desalting test facility. You will hear more about this cooperative effort from the next speaker, Roswell City Manager Jim Whitford.

The institute has learned valuable lessons in its cooperation with outside funding agencies. We know that cooperation with other agencies as well as private industry enhances our ability to carry out research on critical water problems. Above all, we know that the institute's ability to carry out its research mission depends on the high quality of the scientists who participate in our research program.

[The statement of Dr. O'Connor follows:]

STATEMENT OF DR. GEORGE A. O'CONNOR

ACTING DIRECTOR OF THE NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE

BEFORE THE INVESTIGATIONS AND OVERSIGHT SUBCOMMITTEE OF

THE U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE AND TECHNOLOGY

MAY 13, 1983

Good morning. I am George A. O'Connor, acting director of the New Mexico Water Resources Research Institute. I am here today to address the issue of joint utilization of funding, of people and of facilities, and how this cooperation relates to water research. I will begin with a short description of the institute's mission and its role in administering water resources research.

The institute's mission is three-fold. Its primary goal is to encourage and sponsor water resources research. The institute's aim also is to make water research information available through several technology transfer mediums such as conferences and publications. No less important is the institute's role in encouraging the training of young scientists.

When the Water Resources Research Institute was established in 1963, it was decided that the institute would not support an in-house research staff. Instead, the institute was to play an administrative coordinating role in the state's water research program.

That decision has proved crucial to the institute's ability to respond to New Mexico's water problems. Because we are not bound to specific research disciplines, we have the flexibility to adjust our

research thrust to meet essential needs. Just as important these days is our ability to adjust to sudden funding changes.

This freedom has made us more sensitive to the availability of scientific and funding resources. It also has made us more agressive in attracting those resources to our research program.

Historically, the bulk of our funding has come from federal sources. However, as the federal investment in water research has diminished, the institute has been able to attract increased support from state and private sources. It is not uncommon for each of these sectors to cooperatively fund a single research project.

Several institute projects have received support from federal agencies such as the National Science Foundation, the Bureau of Reclamation and the Environmental Protection Agency.

In addition to the state's annual allotment program, funding also has come from state-supported agencies, including the Interstate Stream Commission, the New Mexico Department of Game and Fish and the New Mexico Department of Forestry. Private agencies such as the High Plains Associates, Synfuels Convertor, and Ionics, Inc., also have made considerable investment in our water research program.

A prime example of funding cooperation involving desalting demonstrations illustrates the benefits of both cooperative funding and technology transfer. Supported by the WRRI, the Office of Water Research and Technology, the New Mexico Interstate Stream Commission and Ionics, Inc., researchers built a mobile desalting van to demonstrate on-site reverse osmosis and electrodialysis techniques in desalting water for public supply.

Because the van was taken into the communities, residents could judge for themselves how well the techniques worked in solving their particular water problems. The communities also were given an idea of how much the desalting would cost.

The institute, for all its ambitions, is not one of the big spenders in research. We rarely allot more than $25,000 per year for one project. This money often matches or supplements funding from other sources. We encourage researchers to use this as "seed money" to attract other project sponsors.

A WRRI salt grass research project, for example, started as a small one-year project funded through the institute.. Then, because the preliminary results proved promising, the project received a federal/ state cooperative matching grant for greenhouse testing. Because those tests showed that salt grass has high productivity under the light and salinity conditions expected in the field, the project has received long-term support for field research.

Another research project that could follow the same trend is one dealing with the on-site analysis of metals in water. The institute funded the initial research and is now asking for federal cooperation for further development. And because the project has direct application for industry, we hope industry will support the final stage, implementing the technique in plant design.

The institute's research program, because it involves both the scientists and the facilities of New Mexico's educational institutions, indirectly influences the state's educational programs. For instance, our research mission attracts certain disciplines. In turn, researchers

in these disciplines are attracted to a university in part because of the opportunity for research.

A direct result of institute-sponsored research on curriculum is the inclusion of about three undergraduate or graduate courses each year in water-related areas.

Water resources research is also a valuable training ground for young scientists. The link between the educational system and industry is crucial to future scientific and industrial productivity. For this reason, student employment is encouraged in every institute research project. In the past 10 years, an average of 90 students a year have worked on institute-sponsored research projects.

The educational process of preparing students for careers in science and technology enhances the effectiveness of the federal research dollar. These students will someday contribute to the nation's pool of trained scientists from which industry and research can draw in maintaining high quality programs.

Another facet of the institute's research program is water resources information. The Annual New Mexico Water Conference is our most public outlet for water resources information. For 28 years, the institute, on the recommendation of its advisory committee, has chosen a specific New Mexico water problem as the conference theme. This year, the institute cooperated with the New Mexico Environmental Improvement Division and the U.S. Geological Survey in presenting a day-and-a-half conference on water quality.

The annual conference, as a public forum, also allows the citizens of New Mexico to express their views on water issues. This public

participation helps the institute focus its program on areas of the greatest need.

The institute also publishes the research results of every project it administers. These publications are a valuable source of information for other researchers, water resources agencies, extension agents and water users. The institute also houses some 4,000 volumes in its water resources library.

The institute's statewide research role provides invaluable access to the scientific talent and facilities of the state's universities. Through this cooperation, the institute makes the maximum use of the taxpayers' education and research dollar.

An example of an institute-sponsored project which has a high-value return for very little investment is a water harvesting project at New Mexico State University's Plains Branch Agricutural Experimert Station.

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industry and the City of Roswell on this multidisciplinary two-year project involving the Roswell Desalting Test Facility. You will hear more about this cooperative effort from the next speaker, Roswell City Manager Jim Whitford.

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Mr. SKEEN. Thank you very much, Dr. O'Connor.

We have James Whitford, who is the City Manager of Roswell.

Mr. WHITFORD. In the interest of brevity and clarity, I hope you won't mind too much if I summarize my written statement.

As Claire mentioned a few minutes ago, the Roswell test facility constitutes what we hope to be a highly successful cooperative arrangement between the public sector and the private sector, but I think I would be remiss in not pointing out that this has been a cooperative arrangement since the inception of the program in the early 1960's.

The State of New Mexico and the city of Roswell acquired some real estate on which the Roswell test facility was developed, and conveyed it to the Department of the Interior at no cost.

Additionally, the city of Roswell constructed a water line from the city approximately 7 miles to the east to service the facility. The city has been selling to the facility water from its system and purchasing from the facility the potable water that was developed there through various processes under experimentation.

Additionally, the city has benefited by the payroll and by the infusion of private researchers into the community over the past 20 years. At one time, the facility was producing as much as 750,000 gallons per day, which is no small amount in Roswell, where the average usage runs about 15 million gallons a day.

Since you are personally very well aware of the facility, Congressman Skeen, I will not mention the physical characteristics of the facility beyond saying that it is a multi-million-dollar facility, and the physical plant contains several buildings and several storage tanks, all of which are available for research.

During the 20-years before the facility was transferred to the city of Roswell, it figured very prominently in the testing of water for processes for desalinating water. Vapor compression-distillation process, reverse osmosis desalination, electrodialysis, and eutetic freezing pilot processes were all experimented with at the Roswell test facility.

In mid-1982, faced with Federal budget cutbacks and an administration intent on replacing Federal with other initiative, the de-

partment sought to transfer the Roswell test facility to a qualified, outside operator, and there being none forthcoming from the private sector, the city of Roswell stepped in to preserve the facility for water research and community development.

Since the cooperative agreement was signed in January and the city assumed full operational responsibility, the city has been actively promoting the use of the facility to both public and the private sectors. So far we have been successful in recruiting—if I may use the word. FilmTec Corp. and Ionics, Inc., are two examples.

As George O'Connor said, the New Mexico Legislature, this session, appropriated the amount of $500,000 to the New Mexico Water Resources Research Institute to conduct over the next 2 years research on salt-tolerant crops, greenhouse and hydroponic processes, and aquaculture. How does the city—or should I say why does the city want to participate in this type of an operation? How do we envision the cooperation and what benefit do we expect to receive in the next several years?

First, the area of research. If I could allude to the research and facilities plan of New Mexico State University, it identifies water as one of the resources that will require reallocation to meet the State's future needs. The plan points out that the population is growing at more than double the national rate and that agriculture presently consumes 72 percent of the State's total available water. Clearly, if water is going to be diverted to urban use, agriculture is going to suffer. This is not just a problem with New Mexico. It's a problem with the Southwest.

And as you know, being on the Committee on Science and Technology, it's a problem that is increasing in this Nation and extends beyond our borders to other nations.

One solution would be to develop alternative sources of water. Desalination offers a bright prospect for obtaining potable supplies from the now unusable, vast quantities of saline sea and ground water. As you know, Representative Skeen, there is a vast quantity of ground water in the Roswell area. Private industry can use the Roswell test facility to develop the processes, if needed, to make this bright prospect a reality.

Presently, the FilmTec Corp. of Minneapolis is conducting a reverse osmosis elements test program at the facility. Rohm and Haas will soon be conducting similar experimentation, and Ionics, Inc., wants to test an electrodialysis process there.

A second solution would be to substitute saline waters for fresh in selected farming practices—and this is where the research that is going to be conducted by the Water Resources Research Institute comes in. The WRRI intends to demonstrate feasibility of salt-tolerant crops and intends to work with corporations and to some extent agriculture. This work is going to build on some promising work that was begun in California, but hopefully individualize it for the New Mexico environment.

I should mention one thing with respect to research. This year the Congress appropriated $6 million for water research, and I understand that the administration, already appearing before Representative Yates, has indicated that it sees no reason for funding saline water research next year.

As a manager now of a facility that is, to some extent, dependent upon that type of water research, but more importantly, I think as a citizen of an area of the Nation which is very fast approaching a crisis in water—the west Texas area, the southeastern New Mexico area—I would certainly encourage the Congress to take a very good, long look at that recommendation.

The city of Roswell test facility is capable of producing a very high quality water through various experimental processes. The Roswell test facility is capable of producing extremely high quality water with as little as 200 parts per million of total dissolved solids.

This high quality water can act as an inducement to industries that would use this water in their processes, for example, the chemical industry, photofinishing, and certain high-tech industries in the electronics field. So we see that possibly we can get the plant up and running and producing enough water through the experimentation that is going on there.

The high-quality water itself may be considered a byproduct to attract industry to the area. And, third, the potential for this is far into the future because desalination is not cost-effective, but were it to be made cost-effective hopefully through some of the processes experimented on at the Roswell test facility, the Roswell test facility could serve as a significant source of supplemental water to the city's water system. I hope that I have been able to convey to you how this investment by Federal, State, and local government and private industry in one cooperative program can be capable of mutual benefit.

Hopefully, working together, we will be able to optimize this program, enabling the Roswell test facility to reach its full research, industrial, and municipal potential. The city of Roswell is not now just a participant but the driving force behind this program because it believes that full participation of various public and private entities, even though their objectives may be diverse and sometimes conflicting.

The United States for many years played a major role. It has now assumed diminished responsibility. I encourage you to insure that it does not absolve itself of all responsibility in the area of water research.

Thank you.

[The prepared statement of Mr. Whitford follows:]

STATEMENT OF JAMES B. WHITFORD, JR., ROSWELL CITY MANAGER, BEFORE THE INVESTIGATIONS AND OVERSIGHT SUBCOMMITTEE OF THE COMMITTEE ON SCIENCE AND TECHNOLOGY, U.S. HOUSE OF REPRESENTATIVES, LAS CRUCES FIELD HEARING, LAS CRUCES, N. MEX., MAY 13, 1983

I welcome the opportunity to discuss with you this morning a program which has great potential for becoming a highly successful cooperative arrangement among federal, state and local governments, and private industry in the shared use of research facilities. This program is the Roswell Test Facility (RTF), a multi-million dollar water research center located approximately seven miles east of Roswell, New Mexico.

Although the City of Roswell and the United States entered into formal agreement pertaining to the RTF only earlier this year, cooperation among governments and the private sector has existed since the very inception of the program, back in 1962. The State of New Mexico and the City of Roswell acquired the real estate requisite for the Roswell Test Facility, and conveyed same to the United States at no

cost. The improvements were constructed, equipped and staffed by the U.S. Department of the Interior. The City extended water lines approximately seven miles beyond its limits to service the RTF, again at no cost to the United States. The Department purchased system water from the City, and the City in turn purchased from the Department potable product water from the desalting processes tested at the RTF. These processes were developed by private industry, often through federal funding assistance. Many of these processes now provide or supplement community water supplies at home and abroad, and otherwise contribute to technological capabilities. In the 1970's, the Department discontinued direct operation of the RTF. A private-sector contractor was brought in, I understand at a savings to the Department. Throughout the years, the Roswell community benefited from the jobs and from the product water. The infusion into the local economy amounted to several hundred thousand dollars per year. At one time, almost 750,000 gallons of high quality water was supplied each day to the City's water system, no small quantity in arid eastern New Mexico.

Before commenting on the present, it might be helpful if I briefly describe the Roswell Test Facility. It was constructed twenty-one years ago to develop saline water conversion technology and for other related research. The physical plant is extensive, situated on more than twelve acres. Main facilities include an expansive office building containing a well-equipped laboratory; two larger experimentation centers having several test pads and water blending equipment, and a number of large water storage tanks. During the past two decades, the Roswell Test Facility has figured prominently in this nation's efforts toward researching brine and brackish water purification, and investigating the operational costs and benefits of various desalting processes and products. Its major contributions include testing:

Vapor compression-distillation process—vapor raising under pressure and heat the water to temp to change from liquid to gas—vacuum causes water to vaporize at a lower temperature—calcium ionization.

Reverse osmosis desalination process—molecules of pure water—filter gets rid of organic matter through activated charcoal first bladder out of deer.

Electrodialysis process—electrical charge that will attract positive ions—sodium, calcium; negative—chlorine.

Eutetic freezing pilot process—pure water will freeze at higher temp 30° than salt water.

Each of these experimental conversion processes has used different equipment to remove the total dissolved solids from the water.

In mid-1982, faced with federal budget cutbacks and an Administration intent on replacing federal with other initiative, the Department of the Interior sought to transfer the RTF to a qualified, outside operator. When it became apparent that none would be forthcoming from the private sector, the City of Roswell stepped in to preserve the RTF as a valuable resource for water research and community development. A cooperative agreement was negotiated between the City and the Department, and the City assumed operational responsibility on March 1, 1983. Under this agreement, the Department closely monitors the City's performance, and the Federal and City Governments equally share user fees. The City is able to assess charges to users to defray its cost of operation. Public and private entities are availing themselves of this research center. Among those presently using or expected to soon use the RTF are: New Mexico State University, New Mexico Water Resources Research Institute, FilmTec Corporation, Battelle Laboratories, and Ionics, Incorporated. Legislation has been introduced in the Congress to transfer the Roswell Test Facility to the City. This legislation stipulates that the City will contine to operate the RTF for water research through 1987. However, as the city is seeking to preserve the RTF as a water research center, it can now not foresee abandoning that purpose at any time in the future, unless the associated cost should become prohibitive. Regardless, the United States is assured that federal objectives will continue to be met for at least five years more without direct federal funding involvement.

How does the City envision the public and private sectors benefiting through continued cooperation in maintaining the Roswell Test Facility? Let me be specific.

Research

The five-year augmented research and facilities plan of New Mexico State University identifies water as one of the resources that will require reallocation to meet this state's future needs. The plan points out that New Mexico's population is growing at more than double the national rate, and that agriculture presently consumes 72 percent of the state's total available water. Clearly, if water is going to be diverted to urban use, agriculture is going to suffer.

Is this a problem of just New Mexico? Unfortunately, it is not. You as members of the Committee on Science and Technology well realize that this is an increasing problem of national magnitude, and one that extends beyond our borders to many areas of the world.

One solution is to develop alternative sources of water. Desalination offers a bright prospect for obtaining potable supplies from the now unusable, vast quantities of saline sea and ground water. Private industry can use the Roswell Test Facility to develop the processes needed to make this bright prospect a reality. Presently, the FilmTec Corporation of Minneapolis is conducting a reverse osmosis elements test program at the RTF. Rohm and Haas will soon be conducting similar experimentation, and Ionics, Inc. wants to test an electrodialysis process there.

Another solution would be to substitute saline waters for fresh in selected farming practices, with an eye toward conserving high-quality water for other uses. This year the New Mexico State Legislature appropriated $500,000.00 to New Mexico State University to use the RTF to demonstrate the feasibility of salt-tolerant crops, greenhouse and hydroponic processes, and aquaculture. The work will build on promising research results from California, but will be custom-tailored to the unique features of New Mexico's climate and ground water.

With respect to research, the Congress this year appropriated $6 million for water research. Certainly, some of this funded research can and will be done at the Roswell Test Facility. I understand, however, that the Administration is recommending no federal funding for saline water research next year. I am of the opinion that that recommendation is short sighted, if not irresponsible. I say this not just as a manager responsible for a facility dependent upon water research, but as a citizen cognizant of the coming water crisis in southern New Mexico, west Texas and many other areas of our nation.

Industry

As mentioned previously, the RTF is capable of producing extremely high-quality water with as little as 200 parts per million of total dissolved solids. One of the City's primary objectives with respect to preserving the RTF is to make this high-quality water available to prospective industries whose production is dependent on a supply of such water. The electronics, chemical and photo-finishing industries are three that could be attracted to Roswell for this high-quality water. The expanded industrial base would help create jobs in the community. Light industry would broaden the area's primarily agricultural tax base and increase revenues for City operations, including the RTF.

Municipal

The City of Roswell could anticipate a future major expansion of the RTF to provide potable water for the municipal water system. Although not practical today, further research—possibly even research done right in Roswell—may result in a cost-effective process.

I hope that I have been able to convey to you how investment by federal, state and local governments, and private industry in one cooperative program, the Roswell Test Facility, can be capable of mutual benefit. Hopefully, working together, we will be able to optimize this program, enabling the RTF to reach its full research, industrial and municipal potential. The City of Roswell is not now just a participant, but the driving force behind this program, because it believes that full potential can be achieved only through the participation of various public and private entities, even though their objectives may be diverse and sometimes conflicting. The United States for many years played the major role. It has now assumed diminished responsibility. I encourage you to insure that it does not absolve itself of all responsibility.

Thank you for taking the time to come to New Mexico for my input.

Mr. SKEEN. We would like to ask a few questions, and I would like to start off. I was very interested in the cost feasibility. How much is the city of Roswell—since tracking over this project, has it cost a great deal in subsidization, the operation of the plan, or has it been a fair exchange? Are you approaching any kind of an economic stability or equality in the exchange?

Mr. WHITFORD. We assumed in looking at going into the cooperative, it would take us 2 years of actual promoting plan in order to reach a break-even standpoint. We are operating a facility now on

a much-reduced rate from what the Federal Government was operating it on. Realistically, the facility has not been in full operation for the past 2 years so we have to begin to promote the program again. So far we—again, we are operating with a reduced staff and with reduced capability, but we anticipate this year of being able to recruit approximately 59 percent of our cost.

When I say cost, I mean direct costs associated with the operation of the facility. There are indirect benefits which the community has received and as a result of the operation of the facility, namely, the private research that is done there brings people to our community—they stay in motels, they eat in restaurants—and the community overall benefits.

Mr. SKEEN. Secondary economic benefits.

Mr. NICHOLAS. I wanted to explore that a little further because it seems that Roswell has been pretty farsighted and you see the potential in this kind of facility not only, I assume, in a civic sense of what it does for Roswell, but also in economic terms. I don't suspect that you went into this thinking that the facility was going to fail and was going to cost the taxpayers of Roswell a great deal of money.

As we talk about new ventures with industry and universities and the public sector, why do you think the private sector was not interested in taking over this facility? Did they not see the potential? Was it too long term? What are some of the factors that you think led to Roswell taking over the facility?

Mr. WHITFORD. Let me tell you why we are optimistic first, and we may be too optimistic. Only time will tell. In 1967, Glover Air Force Base, which was the mainstay of Roswell's economy was closed, and at that time the city took the main portion of that former SAC base, which at one time employed up to 20,000 people, and turned it into an industrial park.

Today we have 100 percent occupancy of that industrial park. So with that kind of experience in mind, I guess it does cause us to be somewhat optimistic—hopefully not overly optimistic. I really don't know why private industry is not interested in assuming operational responsibility for the test facility.

The only rationale that I can offer is the fact that private industry has been heavily subsidized in this area for so long that when it was no longer subsidized, it could not see any benefit associated with continuation.

Of course, private industry would not recruit the secondary benefits that the city of Roswell would.

Mr. NICHOLAS. It would seem to me that the exent that the research that is undertaken here results in cheaper costs for water—at least there is certainly that potential—to the extent that it results in patented processes, that they are able to sell elsewhere.

Mr. WHITFORD. Let me tell you how the feasibility worked in the past. Primarily, the Federal Government capped and any research facility came in and tested at no cost to himself. Now we are imposing a cost. Possibly without the secondary benefits, private industry could not anticipate profit under that situation.

Mr. NICHOLAS. Ms. Newcomer, does the Department of Interior view these sort of joint venures as something that is desirable, something they would like to move towards, or do they see them in

a different fashion? What I'm really thinking about is the statement in your testimony that under current authority, the private sector is not eligible to apply for funding.

Under current authority, we have little feasibility administratively to build between Government, industry, and university. I am wondering if the Department of Interior views these joint ventures or partnerships as desirable, what, if any, recommendations would you have to the subcommittee as to how we could help facilitate this?

Ms. NEWCOMER. I think that we do. I think these two examples just show that we have statutory requirements. We do have some problems being flexible. We use the Cooperative Agreement Act of 1977-78 as the innovative vehicle to try to develop such a partnership. So I think we could continue to look for different vehicles so that we can move in this direction. We definitely do support that.

Mr. NICHOLAS. So those are not necessarily legislative impediments. They're more development of programs because the Cooperative Grants and Cooperative Agreement Act is applicable to all Federal agencies?

Ms. NEWCOMER. Exactly.

Mr. SKEEN. Ms. Newcomer, I would like to also—there were two parallel situations with desalination or with water quality research programs, one being in New Mexico. What was the determination made in the North Carolina case? Did the Department of Interior make some arrangement with the local entity, or what has happened?

Ms. NEWCOMER. Yes. I should have gone into a little more detail, but we signed it in January, a similar agreement with the town of Wrightsville Beach to operate and maintain a facility as the research facility. And, one of the only major differences is that the town there also saw a need to have community services housed in the facility, so they are currently leasing part of that space for town purposes. They are also under a similar agreement and have taken over operation of the facility as it occurs.

Mr. SKEEN. It's going along all right at this point?

Ms. NEWCOMER. Yes.

Mr. SKEEN. I think it was very interesting that the Interior appropriations had made that statement. I had not heard that out of any funding they have for water research programs, none of it should go to desalination programs. I'm a little puzzled by that. Jim, could you expand on that? I also happen to have the GAO report that says desalination programs will not solve it, but it can help.

Mr. WHITFORD. There are a lot of municipalities where it does solve the water problem right now. What I mean there, Congressman, was that I understood that the administration had told the House Appropriations Subcomittee that it did solve a need for continued funding for saline water research. It has been very supportive of saline and all research in the past.

Mr. SKEEN. As far as speaking for the House, that's really a strong leg up because we have to fight him off in some other situations. Maybe we can strike a kind of a balance here. But I was a little bit shocked. I had not heard that statement coming in that committee or from the administration. I am pleased that you have

given us some insight. You are picking up more information than we are getting in that particular area.

Mr. WHITFORD. Possibly Claire could expand on that.

Ms. NEWCOMER. The request for fiscal year 1984 is for zero funding for saline water research.

Mr. SKEEN. I can understand because I think, too, that the Department of the Interior had decided that there should not be an overall Federal water policy as such, and that some be developed at the State levels, which I can agree with. So I think that possibly, viewed from that standpoint or from that stance, the administration feels that it should not be funding these kinds of programs.

But I think that they are kind of shortsighted as far as basic research in desalination because it does not only affect the Western States, it is now having an effect on Midwestern and Eastern States as their water quality has dropped substantially. I think it is a grave concern.

Does anyone else have any questions or any statements?

Mr. TABER. My name is Joseph Taber. I am director of the New Mexico Petroleum Recovery Research Center. And when I received the phone call about this hearing, I said, "I would like to make a very brief statement because I feel the petroleum center is an excellent example of this joint funding for research facilities."

The petroleum center was started by the State of New Mexico and then was supported rather substantially and still is by the Federal Government. But more recently, the research is being continued more, and more support from industry, and the point I am trying to make is that industry would not have come forth with this support and they wouldn't be sharing in research results were it not for the support by the Federal Government.

And, of course, the additional support and continuing support by the State. So these three entities—and we are part of New Mexico Tech—are working together very effectively, and I think it's a good example of how this system does work and is continuing to work.

Mr. SKEEN. Thank you very much. If you have a prepared statement that you would like to have put in the record, we would be delighted to make it a part of the record.

[The prepared statement of Mr. Taber follows:]

New Mexico
Petroleum Recovery Research Center

A Division of
New Mexico Institute of Mining and Technology

Socorro 87801

STATEMENT BY JOSEPH J. TABER
DIRECTOR OF THE NEW MEXICO PETROLEUM
RECOVERY RESEARCH CENTER
A DIVISION OF
NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY
BEFORE THE
INVESTIGATIONS AND OVERSIGHT SUBCOMMITTEE
OF THE
HOUSE SCIENCE AND TECHNOLOGY COMMITTEE
LAS CRUCES, NEW MEXICO

MAY 13, 1983

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Mr. Chairman, my name is Joseph Taber, and I appreciate the opportunity to make this brief statement at your Field Hearing on the Joint Use of Federally Supported Research Facilities. We feel that New Mexico's Petroleum Recovery Research Center (PRRC) is an excellent example of:

(1) the joint sharing of research facilities, and

(2) the benefits of cooperative funding by Federal State and other sources.

The Petroleum Center was started entirely with State funds, then supported substantially by Federal grants or contracts, and now, the industrial sector is coming forth with significant funding to support those projects which have attracted favorable attention on the State, National and International level.

At the Petroleum Center there are 35 full-time people at work on the various laboratory projects, plus 23 students employed on a part-time basis. Most of these workers are paid by a mixture of State, Federal and industrial funds.

Significant technological advances have come from the intensive laboratory work at the Petroleum Center. Included are Norman Morrow's work on the factors which affect permeabilities of tight gas sands and Dave Martin's improvements in the polymers used for waterflooding. Although these improvements in water-soluble polymers were made with Federal funding, some industrial organizations now provide support for more development work.

As we all know, carbon dioxide is a valuable resource in New Mexico, and the Center may be best known for the extensive work by John Heller and Lynn Orr on the use of carbon dioxide for oil recovery. A good example, is the technological breakthrough by Lynn Orr's research group which invented an apparatus for obtaining the engineering information needed on the crude oil-carbon dioxide mixtures when planning a CO_2 flood on an oil field. Their achievement obtains more information in only one-tenth the time needed for such work in the past. This device, along with other work on CO_2 flooding has attracted much attention from oil companies in the United States and abroad, and many have sent engineers and scientists to learn about this high technology development in New Mexico.

Even though most of the federal funding was awarded for the laboratory developments, the Petroleum Center staff has been working very hard to transfer its technology to the oil and gas fields in the State. Time permits the mention of only two of these projects.

One project involved both laboratory and field work in cooperation with Moranco to improve the injection rate in the Hobbs waterflood. Calculations from the lab tests indicated that the injectivity should be improved by 20% with the proper chemical and solvent treatment. The actual treatment of the two test wells did even better than that, and the injectivity has continued to stay high. As a result of the treatment, the operator can inject more water at lower pressures than before.

The most successful field trial was an enhanced gas recovery project conducted with Yates Petroleum in the Permo-Penn formation near Artesia. This test consisted of a massive hydraulic fracture job to break the rock allowing better gas flow into the well, after which 70,000 gallons of liquid CO_2 were added to help clean out the fractures. After several weeks, the well belched up water and fracturing liquids, and then the gas production started to climb. Before the treatment, the well produced only 295,000 standard cubic ft/day of gas, and after treatment, it reached as high as 879,000 cubic ft/day - almost a 3-fold increase. Currently, it has leveled off at about 800,000, and so economic payout for this large project required only about 9 months.

The point is, that this vigorous research and development program would not exist were it not for the initial support of the State and Federal Governments. Thus, the joint sharing of Federal, State and Industrial resources can result in a large benefit to many citizens of the State and the Nation.

Thank you, Mr. Chairman, for the opportunity to make this statement.

Mr. SKEEN. Mr. Goodrich.

Mr. GOODRICH. Jim Goodrich again, on another subject. I won't introduce myself, but I am going to put some extended remarks in writing to you afterward. I am feasibility consultant. I am on two committees of the American Society of Civil Engineers, Water Resources Plannning, and Management Division. These two commmittees are the Research and Information Committee and the Systems Committee.

On the Research and Information Committee, we determine areas in which research on water and water resources is needed. There are some new areas—some six or eight new areas—that we have determined in the last year. I won't go into what they are. But we also provide assistance, when asked for in some cases; voluntary in other cases, to our congressional delegations. Mostly that information is furnished through our key contract program in Washington. Frank Musica down there is the channel.

But specifically on the things that have come up here in this hearing, research is not finished on desalination and renovation of water. The need is increasing rather than decreasing, even with the results that we have had on desalination studies. I don't want to take up more of your time, but I will give you some extended remarks.

Mr. SKEEN. Mr. Goodrich, I just want to thank you because you have evidently put a lot of thought into the two subjects that you have dealt with today, and we appreciate that. And if you would submit anything that you have in writing, we would be very appreciative and delighted to make it a part of the record.

[The prepared statement of Mr. Goodrich follows:]

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May 13, 1983

JAMES L. GOODRICH, P. E.
MRS. HELEN E. BARTLETT
ING. LUIS R. CAMACHO A.
GEORGE PENDELL, P. E.
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REMARKS OF JAMES L. GOODRICH, PROFESSIONAL ENGINEER AND FEASIBILITY CONSULTANT, PARTNER IN PROFESSIONAL BUSINESS FIRM OF GOODRICH-BARTLETT & ASSOCIATES

AT THE FIELD HEARING IN

LAS CRUCES, NEW MEXICO
MAY 13, 1983

Honorable Joe Skeen,
House of Representatives
Washington, D.C.

I am James L. Goodrich, Professional Engineer and Feasibility Consultant with Goodrich-Bartlett & Associates, Advance Planning-Feasibility-Coordination Consultants.

During the past year and a half we have dedicated ourselves to establishing a technology transfer mechanism, locally, which we chose to name: APPLIED RESOURCES DEVELOPMENT RESEARCH ACTIVITY. The entity is intended to satisfy the concept indicated in Public Law 96-480, An Act To promote United States technological innovation for the achievement of national economic, environmental, and social goals, and for other purposes.Unquote.(A reproduced copy of PL 96-480 is appended to these remarks).

ARDRA is the acronym for the name of the entity and will also serve as a protocol in microcomputer network communications.

The model ARDRA is structured as a team of teams of personnel positions called "slots", plus an administrative and advisory group. Personnel to fill the slots are drawn on an ad hoc basis from their regular employment position, University enrollment or professional engagement, their individual selection depending on the main functional purpose of the team, (like: Analysis, Research, Education, etc.), and the kind of task, problem or project involved. The positions (slots) will be designates: P-1 Leader; P-2 Recorder; P-3 Editor; P-4 & P-5 Report Formulators(2); and P-6 & P-7 Observers and Assistants to P-4s & P-5s. Candidates for positions P-1 and P-3 shall be registered professional engineers having excellent career professional and personal records and 15-years or more of versatile professional engineering experience including recent status as Professional Engineer in Private Practice (PEPP). Candidates for all other "team slots" shall be Masters or PhDs in Engineering, Engineering Technology, Agriculture, or MBAs in Business Administration, with or without industrial experience.

ARDRA may be, either, cooperating, affiliated with or integral with the New Mexico State University, and its purposes and functions shall be:

1. (Continued on Page 2)

(Functions shall be): To . . .

a. Create a closely knit working group the individual members of which have extensive knowledge, talents, and expertise in several to many diverse fields and disciplines, and who can perform synergetically and cooperatively to produce creative and feasible solutions for, and transfer technology to, ARDRA's clients and cooperating institutions;

b. Obtain mutual exchanges of information and ideas, among members of the team and also between the team and the client or other sources, especially concerning current and projected state-of-the-art know-how and can-do expertise.

c. Constitute a virtual interface, substantially closing the time and distance gap to communication, between elements of the industry-government-academe triad.

d. Provide a "hands-on" opportunity to members of the team to gain so-called "industrial experience" before actually working in an industrial environment.

e. Enhance the performance capability and virtuosity of all participants on the team, and upgrading and updating their individual comprehension.

ARDRA's structure, organization and methodology are derived from the evolution of program and project control and execution at White Sands Missile Range and the professional practice of myself, James L. Goodrich, Professional Engineer and Feasibility Consultant, as to specialization for more than 25-years.

Demonstration of achievement of purposes and functions objectives, just mentioned for ARDRA, was accomplished, unintentionally, by the Physical Science Laboratory of New Mexico State University (Clinton P. Anderson Physical Science Laboratory) in the handling and performance of a study and report on RATSCAT TEST FACILITY, analysis of established concepts and recommendations for siting, in which I participated as a consultant to PSL.

The RATSCAT feasibility study was made during April and May of 1982, for a facility required to become operational at a very early date and requiring several construction features that currently were stressing or beyond the then state-of-the-art in at least two engineering disciplines. PSL performed its mission for Dynalectron Corporation on request of the United States Air Force.

To accomplish the mission PSL put together an ad hoc team comprised of eight(8) PSL staff personnel, a project manager, general engineer, construction engineer, digital mapping, radio frequency antennae, graduate student engineer, hydrology-geology and contract administration specialists; together with PSL consultants on engineering feasibility & planning(ARDRA), human systems research, geodesy & cartography, photogrammetry & surveying, and soils test laboratory.

 (Continued on Page 3)

Project basic mandatory construction design criteria called for a mirror finish flat maintainable surface having dimensions of 2-miles length by 300 feet width, laterally level but longitudinally not necessarily level(could be sloped). Surface tolerance was required to be as good or better than the best existing State highway construction specification surface tolerance specifications, which is 3/8" plane difference measured over a 10 foot span. The mirror surface is required to reflect radar frequencies ranging from kilohertz to gigahertz. An emerging new technology, called laser-beacon controls adapted to street and highway pavers makes it possible to gain the precision construction performance that will meet the stringent requirements of this project. Laser-beacon controls have not been fully commercialized but are custom adapted to pavers and land levellers by R&D enterprise, Spectral Physics, Ray Bulger, 5475 Kellenburger Road, Dayton, Ohio 45424, and another address in California. Finding this new application reminded us that agriculture has been searching for better ways to level large areas of land. On Ratscat there were other highly challenging needs that were met by innovation.

We have been asked - many times - "just where and why is there a need for an innovation center"? The main need is that industry in general does not now have the technical middle management personnel, in numbers or updated know-how and can-do, to enable the individual industries to become competitive. There are lots of contributing reasons for this, but the greatest truth is thattoo few people have been keeping abreast of the tremendous and accelerating explosion of new technologies, some being a merger or confluence of new and old technologies. Many current technologies enable the doing of things thought impossible and most technologies, when applied, result in ways of doing things that are one or more of the following: Better, easier, safer, more economically, etc. An ordinarily smart business man knows that he cannot afford to hire people to mass produce articles that can't compete, or with obsolete methods. there are fewer new creative technical designers/supervisors [redacted] developingthan are being lost by attrition(retiring or career changes). This decline began in 1975 and should reverse during 1983-84. However, the availability of industry technical middle management and University teachers of technology and engineering will remain extremely critical until after 1986 because of the predictable slow rate of improvement. ARDBA will render a valuable service, locally, toward alleviation of the 1984-1986 shortage of updated creative technical personnel.

With specific reference to the New Mexico "RIO GRANDE CORRIDOR" hi-technology new industry development now officially proposed by the State of New Mexico, bear in mind that there are already in existence many institutions which have a tremendous aggregate capability in, or in support of, sophisticated research and development (R&D), and research, development, test and evaluation (R,D,T&E). I include , appended to my extended remarks a summary of capabilities and capabilities which was prepared in 1976 by Goodrich-Bartlett & Associates. There are several new R&D and R&D support activities that should be included in a current listing, not the least of which is TDRSS global Earth terminal and related activities of SPACECOM, WESTAR, NASA and RCA, etc.

Appendix 2
As stated in text

END OF REMARKS

James L. Goodrich

James L. Goodrich PE
Feasibility Consultant

Public Law 96-480
96th Congress

An Act

To promote United States technological innovation for the achievement of national economic, environmental, and social goals, and for other purposes.

Oct. 21, 1980
[S. 1250]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Stevenson-Wydler Technology Innovation Act of 1980".

Stevenson-Wydler Technology Innovation Act of 1980.
15 USC 3701 note.

SEC. 2. FINDINGS.

15 USC 3701.

The Congress finds and declares that:

(1) Technology and industrial innovation are central to the economic, environmental, and social well-being of citizens of the United States.

(2) Technology and industrial innovation offer an improved standard of living, increased public and private sector productivity, creation of new industries and employment opportunities, improved public services and enhanced competitiveness of United States products in world markets.

(3) Many new discoveries and advances in science occur in universities and Federal laboratories, while the application of this new knowledge to commercial and useful public purposes depends largely upon actions by business and labor. Cooperation among academia, Federal laboratories, labor, and industry, in such forms as technology transfer, personnel exchange, joint research projects, and others, should be renewed, expanded, and strengthened.

(4) Small businesses have performed an important role in advancing industrial and technological innovation.

(5) Industrial and technological innovation in the United States may be lagging when compared to historical patterns and other industrialized nations.

(6) Increased industrial and technological innovation would reduce trade deficits, stabilize the dollar, increase productivity gains, increase employment, and stabilize prices.

(7) Government antitrust, economic, trade, patent, procurement, regulatory, research and development, and tax policies have significant impacts upon industrial innovation and development of technology, but there is insufficient knowledge of their effects in particular sectors of the economy.

(8) No comprehensive national policy exists to enhance technological innovation for commercial and public purposes. There is a need for such a policy, including a strong national policy supporting domestic technology transfer and utilization of the science and technology resources of the Federal Government.

(9) It is in the national interest to promote the adaptation of technological innovations to State and local government uses. Technological innovations can improve services, reduce their costs, and increase productivity in State and local governments.

(10) The Federal laboratories and other performers of federally funded research and development frequently provide scientific

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and technological developments of potential use to State and local governments and private industry. These developments should be made accessible to those governments and industry. There is a need to provide means of access and to give adequate personnel and funding support to these means.

(11) The Nation should give fuller recognition to individuals and companies which have made outstanding contributions to the promotion of technology or technological manpower for the improvement of the economic, environmental, or social well-being of the United States.

15 USC 3702

SEC. 3. PURPOSE.

It is the purpose of this Act to improve the economic, environmental, and social well-being of the United States by—

(1) establishing organizations in the executive branch to study and stimulate technology;

(2) promoting technology development through the establishment of centers for industrial technology;

(3) stimulating improved utilization of federally funded technology developments by State and local governments and the private sector;

(4) providing encouragement for the development of technology through the recognition of individuals and companies which have made outstanding contributions in technology; and

(5) encouraging the exchange of scientific and technical personnel among academia, industry, and federal laboratories.

15 USC 3703

SEC. 4. DEFINITIONS.

As used in this Act, unless the context otherwise requires, the term—

(1) "Office" means the Office of Industrial Technology established under section 5 of this Act.

(2) "Secretary" means the Secretary of Commerce.

(3) "Director" means the Director of the Office of Industrial Technology, appointed pursuant to section 5 of this Act.

(4) "Centers" means the Centers for Industrial Technology established under section 6 or section 8 of this Act.

(5) "Nonprofit institution" means an organization owned and operated exclusively for scientific or educational purposes, no part of the net earnings of which inures to the benefit of any private shareholder or individual.

(6) "Board" means the National Industrial Technology Board established pursuant to section 10.

(7) "Federal laboratory" means any laboratory, any federally funded research and development center, or any center established under section 6 or section 8 of this Act that is owned and funded by the Federal Government, whether operated by the Government or by a contractor.

(8) "Supporting agency" means either the Department of Commerce or the National Science Foundation, as appropriate.

Office of Industrial Technology, establishment. 15 USC 3704

SEC. 5. COMMERCE AND TECHNOLOGICAL INNOVATION.

(a) IN GENERAL.—The Secretary shall establish and maintain an Office of Industrial Technology in accordance with the provisions, findings, and purposes of this Act.

(b) DIRECTOR.—The President shall appoint, by and with the advice and consent of the Senate, a Director of the Office, who shall be

compensated at the rate provided for level V of the Executive Schedule in section 5316 of title 5, United States Code.

(c) DUTIES.—The Secretary, through the Director, on a continuing basis, shall—

(1) determine the relationships of technological developments and international technology transfers to the output, employment, productivity, and world trade performance of United States and foreign industrial sectors;

(2) determine the influence of economic, labor and other conditions, industrial structure and management, and government policies on technological developments in particular industrial sectors worldwide;

(3) identify technological needs, problems, and opportunities within and across industrial sectors that, if addressed, could make a significant contribution to the economy of the United States;

(4) assess whether the capital, technical and other resources being allocated to domestic industrial sectors which are likely to generate new technologies are adequate to meet private and social demands for goods and services and to promote productivity and economic growth;

(5) propose and support studies and policy experiments, in cooperation with other Federal agencies, to determine the effectiveness of measures with the potential of advancing United States technological innovation;

(6) provide that cooperative efforts to stimulate industrial innovation be undertaken between the Director and other officials in the Department of Commerce responsible for such areas as trade and economic assistance;

(7) consider government measures with the potential of advancing United States technological innovation and exploiting innovations of foreign origin; and

(8) publish the results of studies and policy experiments.

(d) REPORT.—The Secretary shall prepare and submit to the President and Congress, within 3 years after the date of enactment of this Act, a report on the progress, findings, and conclusions of activities conducted pursuant to sections 5, 6, 8, 11, 12, and 13 of this Act and recommendations for possible modifications thereof. Report to President and Congress.

SEC. 6. CENTERS FOR INDUSTRIAL TECHNOLOGY. 15 USC 3705.

(a) ESTABLISHMENT.—The Secretary shall provide assistance for the establishment of Centers for Industrial Technology. Such Centers shall be affiliated with any university, or other nonprofit institution, or group thereof, that applies for and is awarded a grant or enters into a cooperative agreement under this section. The objective of the Centers is to enhance technological innovation through—

(1) the participation of individuals from industry and universities in cooperative technological innovation activities;

(2) the development of the generic research base, important for technological advance and innovative activity, in which individual firms have little incentive to invest, but which may have significant economic or strategic importance, such as manufacturing technology;

(3) the education and training of individuals in the technological innovation process;

(4) the improvement of mechanisms for the dissemination of scientific, engineering, and technical information among universities and industry;

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(5) the utilization of the capability and expertise, where appropriate, that exists in Federal laboratories; and

(6) the development of continuing financial support from other mission agencies, from State and local government, and from industry and universities through, among other means, fees, licenses, and royalties.

(b) ACTIVITIES.—The activities of the Centers shall include, but need not be limited to—

(1) research supportive of technological and industrial innovation including cooperative industry-university basic and applied research;

(2) assistance to individuals and small businesses in the generation, evaluation and development of technological ideas supportive of industrial innovation and new business ventures;

(3) technical assistance and advisory services to industry, particularly small businesses; and

(4) curriculum development, training, and instruction in invention, entrepreneurship, and industrial innovation.

Each Center need not undertake all of the activities under this subsection.

(c) REQUIREMENTS.—Prior to establishing a Center, the Secretary shall find that—

(1) consideration has been given to the potential contribution of the activities proposed under the Center to productivity, employment, and economic competitiveness of the United States;

(2) a high likelihood exists of continuing participation, advice, financial support, and other contributions from the private sector;

(3) the host university or other nonprofit institution has a plan for the management and evaluation of the activities proposed within the particular Center, including:

(A) the agreement between the parties as to the allocation of patent rights on a nonexclusive, partially exclusive, or exclusive license basis to and inventions conceived or made under the auspices of the Center; and

(B) the consideration of means to place the Center, to the maximum extent feasible, on a self-sustaining basis;

(4) suitable consideration has been given to the university's or other nonprofit institution's capabilities and geographical location; and

(5) consideration has been given to any effects upon competition of the activities proposed under the Center.

(d) PLANNING GRANTS.—The Secretary is authorized to make available nonrenewable planning grants to universities or nonprofit institutions for the purpose of developing a plan required under subsection (c)(3).

Inventions, title acquisition.

(e) RESEARCH AND DEVELOPMENT UTILIZATION.—(1) To promote technological innovation and commercialization of research and development efforts, each Center has the option of acquiring title to any invention conceived or made under the auspices of the Center that was supported at least in part by Federal funds: *Provided*, That—

(A) the Center reports the invention to the supporting agency together with a list of each country in which the Center elects to file a patent application on the invention;

(B) said option shall be exercised at the time of disclosure of invention or within such time thereafter as may be provided in the grant or cooperative agreement;

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(C) the Center intends to promote the commercialization of the invention and file a United States patent application;

(D) royalties be used for compensation of the inventor or for educational or research activities of the Center;

(E) the Center make periodic reports to the supporting agency, and the supporting agency may treat information contained in such reports as privileged and confidential technical, commercial, and financial information and not subject to disclosures under the Freedom of Information Act; and

(F) any Federal department or agency shall have the royalty-free right to practice, or have practiced on its behalf, the invention for governmental purposes.

The supporting agency shall have the right to acquire title to any patent on an invention in any country in which the Center elects not to file a patent application or fails to file within a reasonable time.

Supporting agency licens rights.

(2) Where a Center has retained title to an invention under paragraph (1) of this subsection the supporting agency shall have the right to require the Center or its licensee to grant a nonexclusive, partially exclusive, or exclusive license to a responsible applicant or applicants, upon terms that are reasonable under the circumstances, if the supporting agency determines, after public notice and opportunity for hearing, that such action is necessary—

(A) because the Center or licensee has not taken and is not expected to take timely and effective action to achieve practical application of the invention;

(B) to meet health, safety, environmental, or national security needs which are not reasonably satisfied by the contractor or licensee; or

(C) because the granting of exclusive rights in the invention has tended substantially to lessen competition or to result in undue market concentration in the United States in any line of commerce to which the technology relates.

U.S. Courts of Claims, petition.

(3) Any individual, partnership, corporation, association, institution, or other entity adversely affected by a supporting agency determination made under paragraph (2) of this subsection may, at any time within 60 days after the determination is issued, file a petition to the United States Court of Claims which shall have jurisdiction to determine that matter de novo and to affirm, reverse, or modify as appropriate, the determination of the supporting agency.

Antitrust laws.

(f) ADDITIONAL CONSIDERATION.—The supporting agency may request the Attorney General's opinion whether the proposed joint research activities of a Center would violate any of the antitrust laws. The Attorney General shall advise the supporting agency of his determination and the reasons for it within 120 days after receipt of such request.

SEC. 7. GRANTS AND COOPERATIVE AGREEMENTS.

15 USC 3706.

(a) IN GENERAL.—The Secretary may make grants and enter into cooperative agreements according to the provisions of this section in order to assist any activity consistent with this Act, including activities performed by individuals. The total amount of any such grant or cooperative agreement may not exceed 75 percent of the total cost of the program.

(b) ELIGIBILITY AND PROCEDURE.—Any person or institution may apply to the Secretary for a grant or cooperative agreement available under this section. Application shall be made in such form and manner, and with such content and other submissions, as the Direc-

tor shall prescribe. The Secretary shall act upon each such application within 90 days after the date on which all required information is received.

(c) TERMS AND CONDITIONS —

(1) Any grant made, or cooperative agreement entered into, under this section shall be subject to the limitations and provisions set forth in paragraph (2) of this subsection, and to such other terms, conditions, and requirements as the Secretary deems necessary or appropriate.

(2) Any person who receives or utilizes any proceeds of any grant made or cooperative agreement entered into under this section shall keep such records as the Secretary shall by regulation prescribe as being necessary and appropriate to facilitate effective audit and evaluation, including records which fully disclose the amount and disposition by such recipient of such proceeds, the total cost of the program or project in connection with which such proceeds were used, and the amount, if any, of such costs which was provided through other sources.

15 USC 3707.

SEC. 8. NATIONAL SCIENCE FOUNDATION CENTERS FOR INDUSTRIAL TECHNOLOGY.

(a) ESTABLISHMENT AND PROVISIONS.—The National Science Foundation shall provide assistance for the establishment of Centers for Industrial Technology. Such Centers shall be affiliated with a university, or other nonprofit institution, or a group thereof. The objective of the Centers is to enhance technological innovation as provided in section 6(a) through the conduct of activities as provided in section 6(b). The provisions of sections 6(e) and 6(f) shall apply to Centers established under this section.

(b) PLANNING GRANTS.—The National Science Foundation is authorized to make available nonrenewable planning grants to universities or nonprofit institutions for the purpose of developing the plan, as described under section 6(c)(3).

(c) TERMS AND CONDITIONS.—Grants, contracts, and cooperative agreements entered into by the National Science Foundation in execution of the powers and duties of the National Science Foundation under this Act shall be governed by the National Science Foundation Act of 1950 and other pertinent Acts.

42 USC 1861 note.

15 USC 3708.

SEC. 9. ADMINISTRATIVE ARRANGEMENTS.

(a) COORDINATION.—The Secretary and the National Science Foundation shall, on a continuing basis, obtain the advice and cooperation of departments and agencies whose missions contribute to or are affected by the programs established under this Act, including the development of an agenda for research and policy experimentation. These departments and agencies shall include but not be limited to the Departments of Defense, Energy, Education, Health and Human Services, Housing and Urban Development, the Environmental Protection Agency, National Aeronautics and Space Administration, Small Business Administration, Council of Economic Advisers, Council on Environmental Quality, and Office of Science and Technology Policy.

(b) COOPERATION.—It is the sense of the Congress that departments and agencies, including the Federal laboratories, whose missions are affected by, or could contribute to, the programs established under this Act, should, within the limits of budgetary authorizations and appropriations, support or participate in activities or projects authorized by this Act.

(c) ADMINISTRATIVE AUTHORIZATION.—

(1) Departments and agencies described in subsection (b) are authorized to participate in, contribute to, and serve as resources for the Centers and for any other activities authorized under this Act.

(2) The Secretary and the National Science Foundation are authorized to receive moneys and to receive other forms of assistance from other departments or agencies to support activities of the Centers and any other activities authorized under this Act.

(d) COOPERATIVE EFFORTS.—The Secretary and the National Science Foundation shall, on a continuing basis, provide each other the opportunity to comment on any proposed program of activity under section 6, 8, or 13 of this Act before funds are committed to such program in order to mount complementary efforts and avoid duplication.

SEC. 10. NATIONAL INDUSTRIAL TECHNOLOGY BOARD. 15 USC 3709.

(a) ESTABLISHMENT.—There shall be established a committee to be known as the National Industrial Technology Board.

(b) DUTIES.—The Board shall take such steps as may be necessary to review annually the activities of the Office and advise the Secretary and the Director with respect to—

(1) the formulation and conduct of activities under section 5 of this title;

(2) the designation and operation of Centers and their programs under section 6 of this Act including assistance in establishing priorities;

(3) the preparation of the report required under section 5(d); and

(4) such other matters as the Secretary or Director refers to the Board, including the establishment of Centers under section 8 of this Act, for review and advice.

The Director shall make available to the Board such information, personnel, and administrative services and assistance as it may reasonably require to carry out its duties. The National Science Foundation shall make available to the Board such information and assistance as it may reasonably require to carry out its duties.

(c) MEMBERSHIP, TERMS, AND POWERS.—

(1) The Board shall consist of 15 voting members who shall be appointed by the Secretary. The Director shall serve as a nonvoting member of the Board. The members of the Board shall be individuals who, by reason of knowledge, experience, or training are especially qualified in one or more of the disciplines and fields dealing with technology, labor, and industrial innovation or who are affected by technological innovation. The majority of the members of the Board shall be individuals from industry and business.

(2) The term of office of a voting member of the Board shall be 3 years, except that of the original appointees, five shall be appointed for a term of 1 year, five shall be appointed for a term of 2 years, and five shall be appointed for a term of 3 years.

(3) Any individual appointed to fill a vacancy occurring before the expiration of the term for which his or her predecessor was appointed shall be appointed only for the remainder of such term. No individual may be appointed as a voting member after serving more than two full terms as such a member.

(4) The Board shall select a voting member to serve as the Chairperson and another voting member to serve as the Vice Chairperson. The Vice Chairperson shall perform the functions of the Chairperson in the absence or incapacity of the Chairperson.

(5) Voting members of the Board may receive compensation at a daily rate for GS-18 of the General Schedule under section 5332 of title 5, United States Code, when actually engaged in the performance of duties for such Board, and may be reimbursed for actual and reasonable expenses incurred in the performance of such duties.

45 FR 69201.

15 USC 3710.

SEC. 11. UTILIZATION OF FEDERAL TECHNOLOGY.

Technology transfer.

(a) POLICY.—It is the continuing responsibility of the Federal Government to ensure the full use of the results of the Nation's Federal investment in research and development. To this end the Federal Government shall strive where appropriate to transfer federally owned or originated technology to State and local governments and to the private sector.

(b) ESTABLISHMENT OF RESEARCH AND TECHNOLOGY APPLICATIONS OFFICES.—Each Federal laboratory shall establish an Office of Research and Technology Applications. Laboratories having existing organizational structures which perform the functions of this section may elect to combine the Office of Research and Technology Applications within the existing organization. The staffing and funding levels for these offices shall be determined between each Federal laboratory and the Federal agency operating or directing the laboratory, except that (1) each laboratory having a total annual budget exceeding $20,000,000 shall provide at least one professional individual full-time as staff for its Office of Research and Technology Applications, and (2) after September 30, 1981, each Federal agency which operates or directs one or more Federal laboratories shall make available not less than 0.5 percent of the agency's research and development budget to support the technology transfer function at the agency and at its laboratories, including support of the Offices of Research and Technology Applications. The agency head may waive the requirements set forth in (1) and/or (2) of this subsection. If the agency head waives either requirement (1) or (2), the agency head shall submit to Congress at the time the President submits the budget to Congress an explanation of the reasons for the waiver and alternate plans for conducting the technology transfer function at the agency.

Waiver. Submittal to Congress.

(c) FUNCTIONS OF RESEARCH AND TECHNOLOGY APPLICATIONS OFFICES.—It shall be the function of each Office of Research and Technology Applications—

(1) to prepare an application assessment of each research and development project in which that laboratory is engaged which has potential for successful application in State or local government or in private industry;

(2) to provide and disseminate information on federally owned or originated products, processes, and services having potential application to State and local governments and to private industry;

(3) to cooperate with and assist the Center for the Utilization of Federal Technology and other organizations which link the research and development resources of that laboratory and the Federal Government as a whole to potential users in State and local government and private industry; and

(4) to provide technical assistance in response to requests from State and local government officials.

Agencies which have established organizational structures outside their Federal laboratories which have as their principal purpose the transfer of federally owned or originated technology to State and local government and to the private sector may elect to perform the functions of this subsection in such organizational structures. No Office of Research and Technology Applications or other organizational structures performing the functions of this subsection shall substantially compete with similar services available in the private sector.

(d) CENTER FOR THE UTILIZATION OF FEDERAL TECHNOLOGY.—There is hereby established in the Department of Commerce a Center for the Utilization of Federal Technology. The Center for the Utilization of Federal Technology shall— Establishment.

(1) serve as a central clearinghouse for the collection, dissemination and transfer of information on federally owned or originated technologies having potential application to State and local governments and to private industry;

(2) coordinate the activities of the Offices of Research and Technology Applications of the Federal laboratories;

(3) utilize the expertise and services of the National Science Foundation and the existing Federal Laboratory Consortium for Technology Transfer; particularly in dealing with State and local governments;

(4) receive requests for technical assistance from State and local governments and refer these requests to the appropriate Federal laboratories;

(5) provide funding, at the discretion of the Secretary, for Federal laboratories to provide the assistance specified in subsection (c)(4); and

(6) use appropriate technology transfer mechanisms such as personnel exchanges and computer-based systems.

(e) AGENCY REPORTING.—Each Federal agency which operates or directs one or more Federal laboratories shall prepare biennially a report summarizing the activities performed by that agency and its Federal laboratories pursuant to the provisions of this section. The report shall be transmitted to the Center for the Utilization of Federal Technology by November 1 of each year in which it is due.

SEC. 12. NATIONAL TECHNOLOGY MEDAL. 15 USC 3711.

(a) ESTABLISHMENT.—There is hereby established a National Technology Medal, which shall be of such design and materials and bear such inscriptions as the President, on the basis of recommendations submitted by the Office of Science and Technology Policy, may prescribe.

(b) AWARD.—The President shall periodically award the medal, on the basis of recommendations received from the Secretary or on the basis of such other information and evidence as he deems appropriate, to individuals or companies, which in his judgment are deserving of special recognition by reason of their outstanding contributions to the promotion of technology or technological manpower for the improvement of the economic, environmental, or social well-being of the United States.

(c) PRESENTATION.—The presentation of the award shall be made by the President with such ceremonies as he may deem proper.

15 USC 3712. **SEC. 13. PERSONNEL EXCHANGES.**

The Secretary and the National Science Foundation, jointly, shall establish a program to foster the exchange of scientific and technical personnel among academia, industry, and Federal laboratories. Such program shall include both (1) federally supported exchanges and (2) efforts to stimulate exchanges without Federal funding.

15 USC 3713. **SEC. 14. AUTHORIZATION OF APPROPRIATIONS.**

(a) There is authorized to be appropriated to the Secretary for purposes of carrying out section 6, not to exceed $19,000,000 for the fiscal year ending September 30, 1981, $40,000,000 for the fiscal year ending September 30, 1982, $50,000,000 for the fiscal year ending September 30, 1983, and $60,000,000 for each of the fiscal years ending September 30, 1984, and 1985.

(b) In addition to authorizations of appropriations under subsection (a), there is authorized to be appropriated to the Secretary for purposes of carrying out the provisions of this Act, not to exceed $5,000,000 for the fiscal year ending September 30, 1981, $9,000,000 for the fiscal year ending September 30, 1982, and $14,000,000 for each of the fiscal years ending September 30, 1983, 1984, and 1985.

(c) Such sums as may be appropriated under subsections (a) and (b) shall remain available until expended.

(d) To enable the National Science Foundation to carry out its powers and duties under this Act only such sums may be appropriated as the Congress may authorize by law.

15 USC 3714. **SEC. 15. SPENDING AUTHORITY.**

No payments shall be made or contracts shall be entered into pursuant to this Act except to such extent or in such amounts as are provided in advance in appropriation Acts.

Approved October 21, 1980.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 96-1199 (Comm. on Science and Technology).
SENATE REPORT No. 96-781 (Comm. on Commerce, Science, and Transportation).
CONGRESSIONAL RECORD, Vol. 126 (1980):
May 28, considered and passed Senate.
Sept. 8, considered and passed House, amended.
Sept. 26, Senate concurred in certain House amendments, disagreed to others, and concurred in remainder with amendments.
Oct. 1, House receded from its amendments and concurred in Senate amendments.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 16, No. 43:
Oct. 21, Presidential statement.

EXTRACT

(THIS LISTING IS EXTRACTED FROM THE OFFICIAL PROPOSAL OF GOODRICH-BARTLETT AND ASSOCIATES, JULY 15, 1976, TO U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, WASHINGTON, D.C. , FOR THE MANAGEMENT AND OPERATION OF SOLAR ENERGY RESEARCH INSTITUTE)

SUMMARY OF CAPABILITIES AND RESOURCES

SUPPORT ACTIVITIES AND RESOURCES ESSENTIAL TO SERI/SEIDB
(Abbreviations in parantheses indicates supporting entity)

(WSMR)
1. R & D methodologies, management, documentation, communications.
2. Test and evaluation techniques, integrated measurements.
3. Integrated data collection and telemetry system.
4. Data reduction and analysis-reporting techniques.
5. Real-time data collection, processing, feedback control.
6. Solar high-temp. research laboratory.
7. Microwave communications and relay network.
8. IRIG Timing signals generation and distribution.
9. Multipurpose communications network and area centers.
10. Mobile and portable transceiver microwave stations.
11. Optical design lab., alignment tunnel and moonbeam concentrator.
12. Environmental simulation and accelerated effects labs.
13. Microbiological effects laboratory.
14. Instrument calibrations measurements standards lab.
15. Machine and Metal working shops.
16. U.S. Government procurement and contracting office.
17. Heavy equipment 4th echelon maintenance and repair facility.
18. Pictorial, photographic, cinematic laboratory and services.
19. Closed circuit television data, photography methods.
20. Theater, auditoriums, classrooms, meeting and conference facilities.
21. Cafeterias, dining facilities, commisary, Army and AF exchanges.
22. Aviation support, helicopters, light aircraft fixed wing.
23. Transportation, joint airline reservation and ticket office.
24. Vehicular transportation, public and contract support.
25. Access interface to transcontinental communications networks.
26. Recreational, cultural, social, crafts, hobby fac.
27. Miscellaneous other services and facilities.

(AWS)
28. Atmospheric, meteorological observation and research laboratories.
29. Wind velocity, shear forces, lee-waves research.
30. Meteorological rocket (upper atmosphere and solar effects) network.
31. Synchronous Meteorological Satellite, earth receiving station.

Goodrich PE
APPENDIX 2
1 of 4

FIGURE II-1

II-4

32. Portable weather observation stations (See 10 for communications).
33. Center of meteorological teams scattered among many global sites.

(NSF) 34. Solar activity (SUNSPOT) observatory.

(AFCRL) 35. Free and tethered balloon support (Used extensively in 28).

(WSTF) 36. Project Control Building No. 101, 32,860 SF, 416,905 CF.
37. Briefing Building No. 110, approx. capacity 100.
38. Cafeteria Building No. 111 (Operating for all personnel at WSTF).
39. Test and Control Center (CPC3500 Computer) Bldg.400.
40. Preparation and Test Laboratories (Area 200).
41. Storage and handling facilities, Helium, LOX, LN_2, LH_2, cryogenics.
42. Alcohol storage and handling facilities.
43. Weather transmitting and recording stations.
44. Electronics research laboratory and clean room labs.
45. Altitude simulation laboratories.
46. Outdoors environmental testing accomodations.

(DAJER) 47. Outdoor, desert experimental range, smooth terrain, borders WSTF on east and north, borders Radium Springs KGRA (designated) area on west and BLM geothermal applications area on north. West boundary, at closest, is 5 miles from Interstate 25 and 4 miles from U.S. Reclamation 66 KV electric transmission line which connects Elephant Butte Dam power generating plant and White Sands Missile Range Headquarters Substation. Ref: MAP, Bureau of Land Management, title HATCH SW-24).

(US Bur. of Mines, Socorro) 48. Local Geological Information Source.

(NMBOM) 49. Local Geological Laboratories, library, earth core drilling samples and log reference, geological map making, and literature preparation and printing.

(BLM) 50. Management of land use of Federal lands in Southern New Mexico, maintains library of U.S. Dept. of Interior, Bureau of Land Management Maps, prepares 5-year area management plans and conducts leasing of geothermal exploration lands.

(USBR) 51. Project Control of water and power from Elephant

FIGURE II-1

Butte Dam south to El Paso. Main office located in El Paso, Texas.

(NMSU)	52.	Energy Research and Development Institute.
	53.	New Mexico State University, College of Engineering.
	54.	New Mexico State Department of Agriculture Headquarters (Occupies new 77 000 SF building, solar heated and cooled).
	55.	Clinton P. Anderson Physical Science Laboratory (PSL).
	56.	Water Resources Research Laboratory.
(PSL)	57.	Contract support of R & D projects, design, furnish, operate and maintain computer software, hardware, instrumentation, test beds, facilities, environments. Operates remote sites including overseas locations.
(NMIM&T)	58.	Geological and geophysical research laboratories.
	59.	U.S Navy TERRA Laboratory - fuel test wind tunnel.
	60.	Langmuir Mountain Lab., near-earth thunderstorm and electricity research.
	61.	Workman Lab., design and development of special atmospheric measurement techniques and equipment.
(UTEP)	62.	Metalurgical Laboratories.
	63.	Schellenger Research Institute, Met. and Atmospheric instrumentation, air pollution control and electronic countermeasures. Was collection point for World Wide Weather watch MRN (Global Meteorological Rocket Network).
(UNM)	64.	Coal-gasification research
(SANDIA)	65.	Scale wind tunnel, dynamic and thermodynamic.
	66.	Blue Sky research laboratories.
	67.	Energy and environmental laboratories.
	68.	Intergovernment agency contract support.
(LASL)	69.	Technical, logistical and data communications support and intergovernment agency contract support.
Kirtland AFB	70.	Technical, logistical and data communications support, and intergovernment agency contract support.

FIGURE II-1

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ACRONYM	NAME OF INSTITUTION
WSMR	U.S. Army Test and Evaluation Command, White Sands Missile Range
NOMTF	U.S. Navy Naval Ordnance Missile Test Facility at White Sands Missile Range
..	U.S. Air Force Space and Missile Systems Field Office,WSMR.
WSTF	NASA, Johnson Spacecraft Center, White Sands Test Facility.
NSF	Solar Activity Observatory, Sunspot, New Mexico.
ASL	U.S. Army Electronics Command, Atmospheric Sicences Laboratory.
SMS	Synchronous Meteorological Satellite (SMS) Ground Station.
NMSU	New Mexico State University, Colleges of Engineering, Science, Agriculture.
ERDI	NMSU, Energy Research and Development Institute.
UTEP	University of Texas at El Paso, College of Engineering, Sciences and Metallurgy.
SRI/UTEP	Schellenger Research Institute.
NMIM&T	New Mexico Institute of Mining & Technology.
..	Langmuir Mountain Top Laboratory.
TERRA	U.S. Navy TERRA Field Laboratory.
NMBOM	New Mexico State Bureau of Mines (Headquarters at NMIM&T).
NMDA	New Mexico State Department of Agriculture (Headquarters at NMSU).
DAJER	U.S. Dept. of Agriculture, Jornada Experimental Range.
BLM	U.S. Dept. of Interior, Bureau of Land Management, Las Cruces Office.
USBR	U.S. Dept. of Interior, Reclamation Bureau, Rio Grande Project, Las Cruces Branch.
..	Kirtland AFB - Sandia Laboratories, Albuquerque, N.M.
LASL	Los Alamos Scientific Laboratory, Los Alamos, N.M.

James [illegible] P.E.

PICURE II-1

II-7

Mr. GOODRICH. I might add one more little comment. I am due to make two papers for delivery; one at a national meeting in Houston in October, and one at our Baltimore Water Specialty Meeting in May 1984. The subject of these two: No. 1 will be the impact of new technology on water resources planning and management; the other one will be impact of new laws and regulations on water resources planning and management.

Mr. SKEEN. Thank you once again.

I want to thank all of you that have been here today, panelists, people who have sat through the hearings. I'm sure that it didn't provide you the most exhilarating as far as entertainment value, but I think that probably we have derived a great deal of information.

I know that the contributions made by the panelists to those of us in Congress have been very significant, and I hope the hearing itself will provide the opportunity for joint research efforts in New Mexico and that we send a signal to both the private industry and Federal officials that New Mexico is ready and willing to build for the future with a strong foundation of cooperative scientific and technological research.

So, unless anyone has anything further, I recommend that we conclude the meeting today, with our deepest appreciation and thanks to everyone of you that have participated, and particularly those that have come from such a long way, and we certainly do appreciate it. And it is a significant contribution. We appreciate it.

Thank you.

We are adjourned.

[Whereupon, at 2 p.m., the subcommittee adjourned.]